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AUTHOR	Stecher, Brian M.; Barron, Sheila; Kaganoff, Tessa; Goodwin, Joy
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ABSTRACT

This report is part of a multi-year project to examine the effects of standards-based assessment reform on schools and classrooms. During the past year, the project investigated school and classroom effects of assessment reforms in the state of Kentucky, a state that has been at the forefront of the standards-based assessment movement. This report presents the results of a series of surveys of the impact of the Kentucky Instructional Results Information System (KIRIS) on curriculum and instruction in mathematics in grades 5 and 8 and in writing in grades 4 and 7. Teachers' self-reports (n=approximately 400) indicated substantial changes in classroom practices in response to the Kentucky Education Reform Act and KIRIS. KIRIS, in particular, has had a major influence on instructional behavior according to teachers. However, there were no consistent associations between reports of specific teaching practices or changes in practice during the past 3 years and biennial KIRIS gains. (Contains 2 figures, 31 tables, and 15 references.) (Author/SLD)

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CSE Technical Report 482

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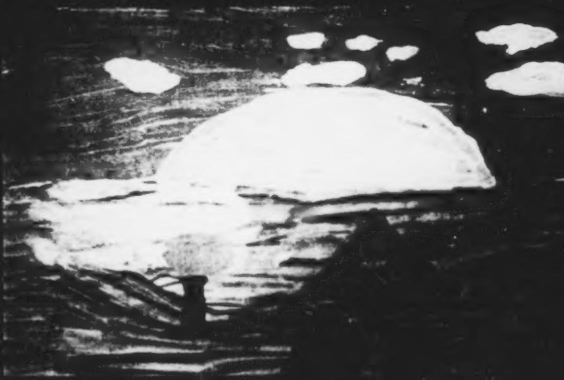

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Center for the Study of Evaluation
National Center for Research on Evaluation,
Standards, and Student Testing
Graduate School of Education & Information Studies
University of California, Los Angeles
Los Angeles, CA 90095-1522
(310) 206-1532

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THE EFFECTS OF STANDARDS-BASED ASSESSMENT ON CLASSROOM PRACTICES: RESULTS OF THE 1996-97 RAND SURVEY OF KENTUCKY TEACHERS OF MATHEMATICS AND WRITING[1]

Brian M. Stecher, Sheila Barron, Tessa Kaganoff, and Joy Goodwin

**National Center for Research on Evaluation, Standards
and Student Testing (CRESST)**

RAND Education

ABSTRACT

This report is part of a multi-year project to examine the effects of standards-based assessment reform on schools and classrooms. During the past year, the project investigated school and classroom effects of assessment reforms in the state of Kentucky, a state that has been at the forefront of the standards-based assessment movement. This report presents the results of a series of surveys of the impact of the Kentucky Instructional Results Information System (KIRIS) on curriculum and instruction in mathematics in grades 5 and 8 and in writing in grades 4 and 7. Teachers' self-reports indicated substantial changes in classroom practices in response to KERA and KIRIS. KIRIS, in particular, has had a major influence on instructional behavior according to teachers. However, there were no consistent associations between reports of specific teaching practices or changes in practice during the past three years and biennial KIRIS gains.

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[1] This project would not have been possible without encouragement and assistance from the staff from the Kentucky Department of Education and cooperation from teachers across the state. In particular, we want to acknowledge the support of Edward Reidy, Deputy Commissioner, and staff from the Kentucky Department of Education, including Brian Gong, Sue Rigney, Starr Lewis, Joanne Mosier, and Jonathan Dings. In addition, we received helpful suggestions from a number of Kentucky regional resource teachers, who were promised anonymity, and from hundreds of Kentucky classroom teachers, who took the time to complete our surveys.

Our RAND colleagues Kathy Rosenblatt, Suzanne Perry, and Linda Daly deserve credit for coordinating the statewide survey effort, including production, distribution, monitoring, review, and data editing.

BACKGROUND

Focus of the Research

In the past few years, there have been important changes in the nature of state assessment program. These changes include the introduction of more performance assessments (including open-response written measures, hands-on tasks, and cumulative portfolios), the alignment of assessments with state standards, and the use of assessment systems for school accountability purposes. Various reasons are cited for these changes. For example, proponents of performance assessments believe that "authentic" measures will lead to more effective instructional practices and will foster children's conceptual understanding (e.g., Resnick & Resnick, 1992; Stiggins, 1991; Wiggens, 1989). The alignment of assessments with state standards is intended to promote improved classroom practice and to provide data for school improvement (Bond, 1994). The implementation of high-stakes accountability systems is supposed to increase attention to performance standards and student outcomes and create mechanisms to change ineffective practices.

Most recent research on large-scale assessment has focused on the quality of scores and their appropriateness for accountability purposes. There has been very little research the effects of standards-based assessments on classroom practices. States and districts that change their assessment systems in one or more of these ways usually rely upon schools and teachers to translate the larger goals into practice. Little attention has been given to the processes through which schools implement and support assessment-based change and teachers adapt the classroom instructional environment to accommodate new curriculum standards and broadened achievement expectations.

This is the first report from a multi-year project investigating the consequences of standards-based assessment reform at the school and classroom levels. The project is designed to address two broad questions: (1) What are the effects of recent statewide assessment reforms on school structures, classroom practices, and teachers' and students' understandings of assessment? (2) Which practices are associated with improvements in assessment results? Information about these processes is crucial to understanding why reform succeeds in some schools and falls short of expectations in others. During the past year, the project investigated teachers' classroom responses to assessment reforms in the state of

Kentucky. Kentucky was selected for study because it has been at the forefront of the standards-based assessment movement in this country.

Standards-Based Educational Reform in Kentucky

Kentucky implemented a new state assessment in 1991 as part of a broader school reform effort embodied in the Kentucky Education Reform Act (KERA). KERA sets learning standards for all students, and KIRIS—the Kentucky Instructional Reform Information System—measures students' progress toward meeting these standards (Kentucky Department of Education, 1994).

The guiding principle behind KERA is that "all children can learn at high levels." To this end KERA delineates six learning goals, four of which address specific academic learning. These four goals include basic communication and mathematics skills, application of concepts and principles from academic subjects to real life situations, thinking and problem solving in school and life situations, and connecting and integrating knowledge across subjects. Each goal is supported by a list of detailed academic expectations for what students will know and be able to do.

KERA also calls for dramatic changes in the way schools approach education. The state's philosophy is expressed in *Transformations: Kentucky's Curriculum Framework*, (Kentucky Department of Education, 1995). The document calls for "a philosophical change from traditional approaches to education" (Kentucky Department of Education, 1995b, p. 1). For Kentucky educators, this change is described by the phrase "standards-based education." A standards-based education emphasizes learning that matters, authenticity of contexts, and realistic demonstrations of performance (Kentucky Department of Education, 1995b, p. 6).

The new assessment system, KIRIS, was designed to be consistent with the philosophy and content emphasis of KERA as well as with themes that characterize assessment reform nationally. First, KIRIS is performance-based in that it relies on constructed-response measures rather than multiple-choice items.[2] The assessment includes "on-demand," open-response questions in several subjects as well as yearlong portfolios in mathematics and writing. Second, KIRIS measures student achievement against specific standards that are set at high levels relative to current performance. Third, KIRIS is a "high stakes" assessment. An annual accountability index is computed for each school based on students' achievement scores and a set of non-cognitive measures, such as attendance and retention. Past performance is used as a baseline to establish improvement targets. For the purposes of rewards and sanctions, Kentucky's accountability system uses two-year averages rather than annual scores. If a school's overall two-year average score exceeds the target based on the previous biennium, the school receives a financial reward. If a school performs poorly for an extended period, the Department intervenes in the operation of the school, for example, by assigning a "distinguished educator" to consult with the school administrators.[3]

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[2] Multiple-choice questions have been included in the assessment off and on over the years but they have not counted in the accountability index.

The Kentucky curriculum framework argues that a "complete transformation of the learning environment" will be required to insure that all children achieve at high levels (KDE, 1995b, p. 3). Districts have the responsibility for seeing that students achieve KERA's learning goals and academic expectations and for making whatever changes are necessary in curriculum and instruction to accomplish this objective. KDE believes that "success with all children will not change unless our practices change significantly" (KDE, 1995b, p. 10).

What will these changes look like? The authors of *Transformations* draw clear distinctions between traditional education, which has not succeeded in Kentucky, and "standards-based education," which they believe holds the key to success. Table 1 summarizes eight ways in which "standards-based education" differs from the traditional approach. These broad statements can be translated into specific classroom practices, such as students working cooperatively to solve problems, inter-disciplinary lessons, and open-ended investigations. The practices encouraged by Kentucky are consistent with the reforms advocated in "Standards" documents prepared by the National Council of Teachers of English, the National Council of Teacher of Mathematics, and other professional organizations. The balance between such "standards-based" practices and more traditional instructional activities serves as one measure of the effects of KERA/KIRIS and other reforms.[4]

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[3] KDE has made a number of changes to KIRIS in response to research findings about the reliability of scoring and validity of scores for accountability purposes. For example, KIRIS originally included multi-disciplinary performance events, but these were dropped from the assessment because of the lack of a satisfactory procedure for linking assessments from year to year. More recently, the mathematics portfolios were placed "on hiatus" for two years while KDE reviewed their design and scoring criteria.

Structure of the KIRIS Assessments

Schools are held accountable for student performance in seven subject areas: reading, writing, mathematics, science, social studies, arts and humanities, and practical living/vocational studies. In the 1996-97 school year, testing was divided across grades to limit the burden on teachers and students in any single grade. At the elementary school level, students received on-demand assessments in reading, science and writing in grade four and in mathematics, social studies, arts and humanities, and practical living/vocational studies in grade five. The same breakdown of subject areas was used for students in middle schools at grades seven and eight. At the high school level, eleventh-grade students completed on-demand assessments in all seven subject areas. In addition, teachers in fourth, seventh and twelfth grades had their students compile writing portfolios. Mathematics portfolios, which have been part of KIRIS in grades five, eight, and twelve, were officially on hiatus during the 1996-97 school year. This study did not explore the effects KIRIS at the high school level

Previous CRESST/RAND Research in Kentucky

RAND has been engaged in an ongoing program of research on the quality and effects of large-scale educational assessments (Koretz et al., 1994; Stecher & Mitchell, 1995). In 1994 RAND began to study Kentucky's assessment system. The first study consisted of surveys of fourth-grade teachers and eighth-grade mathematics teachers as well as school principals across Kentucky (Koretz et al., 1996. These educators were asked about their opinions of KIRIS; changes they had made in instruction, assessment and school management; the methods they used to prepare students for KIRIS; and their implementation of the portfolio component of the assessment. In many ways, the current study is a continuation of this earlier effort, and the results of that research inform the present investigation.

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[4] KDE staff pointed out that a teacher might be engaging in reform activities but not really adopting a standards-based approach. As they see it, a standards-based approach requires that activities be organized in a planned sequence or structure that is focused on the long-term accomplishment of a learning goal. The presence of reform activities is a necessary but not sufficient condition for education to be standards-based. Our surveys contain some question about organizing curriculum units, but focus mostly on instructional activities.

Table 1

Comparison of Traditional and Standards-Based Education

Traditional Approach	Standards-Based Approach
Calendar-Driven Instruction: School structured by calendar, e.g., age grouping, scheduling, etc.	Standards-Driven Instruction: Success based on performance
Constrained Opportunities: Limited instructional strategies, physical environment, time	Expanded opportunities: Teaching time determined by learning and curriculum needs
Cumulative achievement: Work on discrete skills in predetermined time frames	Culminating Achievement: Culminating achievement at the end of a learning cycle
Competitive Learning: Individual environment with competition	Cooperative Learning: Cooperative environment with self-directed challenges
Comparative Evaluation: Based on relative performance of other students	Criterion Evaluation: Based on set standards of quality
Curriculum Coverage: Exact knowledge dissemination within a predetermined timeframe	Instructional Coaching: Finding instructional tools to enable students to demonstrate standards given appropriate time
Segmented Content: Discrete skills with few connections	Connected Content: Integration within and between disciplines, connectedness
Curriculum Design: Focus on segmented coverage	Design Down: Focus on culminating performances

Note. Adapted from Kentucky Department of Education (1995b), p. 9.

With regard to classroom practices, Koretz et al. (1996) found that most principals and teachers felt KIRIS had more than a small positive effect on instruction in their schools. Principals reported focusing a great deal on encouraging teachers to improve instruction—both generally and to prepare students for KIRIS. Most principals also encouraged their teachers a great deal to focus instruction on skills and content likely to be on KIRIS, and nearly all principals reported a moderate or great increase in emphasis on this material. Teachers reported increasing the match between the content of their instruction and the content of the assessments. This included increased emphasis on problem solving, communicating mathematics, and writing. Teachers also increased their use of assessment formats other than multiple-choice.

Virtually all teachers agreed that KIRIS had caused teachers to de-emphasize or neglect untested material, although most principals did not concur that there had been a decrease in emphasis on material not tested by KIRIS in their schools.

In particular, teachers reported less emphasis on the mechanics of writing and on mathematics computation and algorithms.[5]

METHODOLOGY

Data Collection

During 1996-97, we surveyed a representative sample of about 400 teachers from across the state of Kentucky. We also conducted case studies of a dozen exemplary teachers. Surveys were sent to elementary- and middle-school teachers in the KIRIS accountability grades for writing (fourth grade and seventh grade) and mathematics (fifth grade and eighth grade). We selected these subjects because of their importance in the school curriculum and because both were assessed using portfolios, one of the more innovative component of KIRIS. This report summarizes the results of the survey component of the project. Companion reports will describe the case study findings.

Sampling

Two stratification variables were used in drawing the sample: gain on the KIRIS accountability index in the subject of interest, and school size. Schools were placed into three equal strata (low, medium, and high) based on their gain in writing or mathematics during the second biennial cycle (1992-94 vs. 1994-96). Schools were also placed into two equal strata (small and large) based on school size. Schools with fewer than 20 students in the accountability grade were excluded from the sampling frame, as were schools with recent changes in their service areas.

Within each stratum a random sample of schools was chosen. For each of the survey populations (fourth-grade writing, fifth-grade mathematics, seventh-grade writing, and eighth-grade mathematics) approximately 70 schools were selected. No school was chosen for more than one sample. Low- and high-gain schools were over-sampled (two low-gain and two high-gain schools were sampled for every one medium-gain school). The purpose of over-sampling was to increase the power for detecting differences in classroom practices between low- and high-gain schools—one of the main comparisons of interest in this study.

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[5] A recent study of fourth graders' on-demand writing found no change in writing mechanics (capitalization, punctuation, and subject/verb agreement) from 1993 to 1996 (Hoffman, Koger, & Awbrey, 1997).

A letter was sent to the principal of each school at the beginning of 1997 explaining the study and requesting the names of the instructors teaching the identified grade (and subject for middle schools). Principals were subsequently contacted by telephone to retrieve these names. Ninety-five percent of the principals in the sampled schools provided the requested information.

The teachers were contacted by mail and asked to participate in the study. The contact letter explained the study and asked for their participation. Enclosed with the request were a letter from the Department of Education urging teacher cooperation, a copy of the survey to be completed, a return envelope, and a ten dollar gift certificate for purchasing books or other instructional materials. Teachers could keep the gift certificate regardless of whether they returned the survey.

The overall teacher response rate was 70 percent. Table 2 contains the numbers of teachers who returned completed surveys in each of the four samples.

Table 2

Survey Sample and Response Rates

Sample	Schools Sampled	Principals Providing Names	Teachers Contacted	Teachers Returning Survey	Teacher Response Rate
Fourth-Grade Writing	71	65	177	136	77%
Fifth-Grade Math	66	63	125	83	66%
Seventh-Grade Writing	67	66	141	95	67%
Eighth-Grade Math	68	65	116	77	66%

Survey Development

The surveys addressed a broad range of issues related to classroom practices and the goals of KERA. Major themes included school and class organization, curriculum and instruction, classroom assessment, grading practices, and school support for change. In developing the surveys, we did an extensive review of instructional practice questionnaires used in other jurisdictions (e.g., Porter & Smithson, 1995; Center on Organization and Restructuring of Schools, 1994). We adopted or adapted some items from these sources and developed many new items specifically for this study. Most of the survey items focused on behaviors, but we also asked for teachers' opinions about a number of issues, including the KIRIS assessments and their impact on schools, classroom practices, and student performance. The surveys also contained questions related to teacher background and professional development.

One of our purposes was to examine contrasts between practices that were consistent with Kentucky's view of standards-based education and practices that were consistent with traditional views of education (see Table 1). To this end, we developed questions that included practices that typified both approaches. For example, a question about mathematics teaching strategies permitted respondents to indicate the frequency with which they focused on computational skills and problem solving skills.

It is important to note that Kentucky's views of standards-based education and traditional education are not mutually exclusive. Although many instructional practices are identified more closely with either a standards-based approach or a traditional approach, many other practices are compatible with both approaches. As a result, the items in our survey do not always align with only one approach. In this report, we have tried to focus on responses that most would agree are consistent with one approach or the other. However, we admit that this classification is not perfect, and we caution the reader to use his or her own judgment when interpreting the findings.

Most of the survey questions were presented in a closed format. Respondents were asked to provide numerical answers or to select one option from a predetermined set of options (e.g., three-, four-, and five-point Likert scales, and yes/no questions). Some questions permitted respondents to write in other behaviors. For most questions about practice, teachers were asked about current behaviors (during the 1996-97 school year) and about changes during the past three-year period (which comprised the remainder of the accountability cycle). Only teachers with at least three years of experience answered questions about changes in practice. About 15 percent of the elementary teachers and about

20 percent of the middle school teachers indicated that they could not answer these questions.

Data Analysis

We used weights to calculate descriptive statistics because the sampling plan included over-sampling of high-gain and low-gain schools. The weight assigned to each case was the product of the inverses of the probability that the school would be selected and probability that the sampled individuals would participate (complete the survey).

Overall descriptive statistics were calculated separately for each grade and for teachers in high-gain and low-gain schools within each grade. We also combined grades to compute statistics by subject (e.g., the fourth- and seventh-grade responses were combined to calculate overall results for writing). When data were combined across grades, the two grades were weighted equally in the combined statistics. For the Likert questions, frequencies were computed. For questions requiring a numerical response, we calculated means, medians, and standard deviations.

We tested the significance of the differences between responses for teachers in low- and high-gain schools based on second biennium gain scores using chi-squared tests and t-tests, as appropriate. The majority of statistical tests performed were chi-squared tests comparing two groups (teachers in low-gain schools and teachers in high-gain schools) and two levels of response (e.g., no/yes, low/high, or less frequently/more frequently). For this type of comparison and the smallest sample we obtained, a difference in the results for low- and high-gain teachers of anywhere from 16 percent to 30 percent would be needed for statistical significance at an alpha of .05, using no correction for multiple comparisons, and assuming a simple random sample.[6] Differences between mean scores in high-gain and low-gain schools were tested using t-tests. However, we do not emphasize statistical significance in this report, and we do not report the significance of each comparison. In discussing the results of the survey, we focus on sizable differences that also appear to have some practical significance. The reader may want to use 20 percent as a rough guide for judging statistical significance when making other comparisons of teachers in high-gain and low-gain schools.[7]

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[6] We often surveyed more than one teacher in a school, and thus it is likely that there is at least a small clustering effect in the data. For this reason, simple random sample estimates provide only a guide for judging the significance of comparisons. To the extent that a clustering effect is present, accounting for it in significance testing would increase the differences needed to reach statistical significance. The reader should also be aware that hundreds of comparisons were made in this study, and it is probable that some differences between groups were large and statistically significant due to chance factors alone. Caution should be used to interpret differences between groups as suggestive of a relationship between gain and the factor under consideration rather than as conclusive evidence of an effect.

As is the case with all survey research, several factors may threaten the validity of the conclusions reached in this study. There may be selection effects because not all principals provided us with teachers' names, and not all teachers chose to participate. These refusals may have introduced some degree of bias into the reported results. One must also be cautious about self-reported data. Respondents may have answered in ways they considered socially desirable, leading to results that do not reflect teachers' true beliefs.

To avoid overly complex language we will often omit explicit reference to the self-reported nature of the results. "One-half of the teachers have Masters' degrees" is far easier to read than "one-half of the fifth-grade teachers in our sample reported that they have Masters' degrees." The reader should remember that all these results are based on teachers' survey responses. In addition, we occasionally refer to the results for seventh-grade teachers for eighth-grade teachers instead of "seventh-grade teachers who teach writing" or "eighth-grade teachers who teach mathematics," respectively. The reader should keep in mind that we surveyed only writing teachers in seventh grade and only mathematics teachers in eighth grade.

Generalizability of Findings

The teacher samples are representative of Kentucky fourth-grade teachers, fifth-grade teachers, seventh-grade writing teachers and eighth-grade mathematics teachers. To test the validity of the sampling process, we compared the schools in our samples with those in the state as a whole on three variables:

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[7] After the survey was completed, scores for the 1996-97 school year were released, and each school's "mid-point" gain score was computed. These gain scores reflect changes after the first year of the third two-year cycle, i.e., changes from the baseline established in the 1994-96 biennium. This document does not report comparisons based on the mid-point gain scores for a number of reasons. Most importantly, Kentucky uses biennium gains to determine rewards and sanctions because these scores are more reliable than midpoint gains, and we felt that we should be consistent with the state. In addition, we over-sampled based on biennium gains, not midpoint gains, thus we have less power to detect differences using midpoint gains, if they existed.

school size, the baseline accountability index, and the change in the KIRIS accountability index during the second biennium. The school-level means were similar to the population means for all four samples on these three variables. Table 3 contains the sample statistics and the population values for each grade level.

Table 3

Sample and Population Comparison (Mean Values)

	School Size		1996 Subject Area Accountability Index		Gain on Subject Area Index	
	Sample	Pop.	Sample	Pop.	Sample	Pop.
Fourth-Grade Writing	71	69	47.8	47.6	12.5	12.8
Fifth-Grade Math	63	69	37.9	38.8	12.0	12.3
Seventh-Grade Writing	164	162	38.1	37.2	1.5	1.7
Eighth-Grade Math	161	162	38.4	39.9	12.4	12.8

Organization of the Report

The results are organized by subject: mathematics followed by writing. Within each subject, the analyses focus on teacher education and experience, school and classroom organization, professional development, curriculum emphasis, instructional practices, influences on practice and support for change, assessment and grading, and portfolios. Information about differences between teachers in elementary and middle schools and differences between teachers and high-gain and low-gain schools are interwoven in these discussions. The final chapter summarizes the results, highlighting comparisons between mathematics and writing teachers, elementary school and middle school teachers, and teachers in high-gain and low-gain schools. It concludes with a discussion of the implications of these results for Kentucky educators and for standards-based assessment more broadly.

MATHEMATICS TEACHING AND LEARNING

Teacher Education and Experience

In general, Kentucky fifth-grade teachers and eighth-grade mathematics teachers have strong educational backgrounds (albeit in different subject areas), considerable teaching experience, and moderate lengths of service in their current schools. The majority of the fifth- and eighth-grade teachers surveyed reported that they have a master's degree or higher. In fifth grade, 61 percent of the teachers have a Masters' degree and 26 percent have a Kentucky Rank One Certificate, which requires 30 hours of coursework beyond a Masters' degree. In eighth grade, 42 percent of the mathematics teachers have a Masters' degree and 20 percent have a Kentucky Rank One Certificate.

The greater academic preparation of elementary school teachers may be due, in part, to their longer tenures. The median number of years of teaching experience for fifth-grade teachers was 18 years. For eighth-grade mathematics teachers, the median length of teaching experience was six years. Fifth-grade teachers also had more experience at their current school than eighth-grade teachers. The median number of years of teaching experience in their current school was 12 years for fifth-grade teachers and five years for eighth-grade mathematics teachers.

As might be expected, the vast majority of the fifth-grade teachers (85 percent) were certified in Elementary education. However, only 9 percent of fifth-grade teachers specialized in mathematics either in their credential preparation program or when they renewed their teaching credentials. In contrast, eighth-grade mathematics teachers were more diverse in terms of certification and were far more likely to specialize in mathematics. Their teaching certificates were divided roughly equally among Elementary education (39 percent), Middle School (43 percent), and Secondary Grades (30 percent).[8] The majority of the eighth-grade mathematics teachers (61 percent) specialized in mathematics in their teacher preparation program, and a substantial percentage (45 percent) specialized in mathematics when they had their credentials renewed. Overall, about three-quarters (72 percent) of the eighth-grade mathematics teachers specialized in mathematics during preservice training or credential renewal.

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[8] Teachers can hold teaching certificates in more than one category.

There was no difference in teaching experience or subject matter preparation between teachers in high-gain and low-gain schools in either grade level.

School and Classroom Organization

Classroom organization for fifth-grade instruction in Kentucky was more varied than we anticipated. Only about one-third of Kentucky fifth-grade teachers worked in traditional self-contained classrooms. The majority of fifth-grade teachers (59 percent) described their school's instructional organization as "semi-departmentalized," i.e., students were taught their academic subjects by two or three different teachers. This would be the case, for example, if Smith and Jones exchanged students for reading and mathematics, with Smith teaching mathematics to both groups and Jones teaching reading to both groups. This class exchange model applies to at most one-half of the teachers in semi-departmentalized schools. The other half of the teachers in semi-departmentalized schools reported that they teach all subjects. This might be the case if Smith and Jones exchanged some of their students, e.g., a group of students of similar ability, with each one teaching mathematics and reading to a realigned group or if Smith and Jones team teach some subject area.

By the time students reach the eighth grade, they are typically assigned to a different teacher for each subject. In 83 percent of schools, eighth-grade instruction was completely departmentalized, while 17 percent of schools had a semi-departmentalized eighth grade. We found no relationships between school and classroom organization and KIRIS gains in fifth or eighth grade.

The majority of teachers at both grade levels reported that their schools did not group students by ability when assigning them to classrooms. However, ability grouping was almost three times more common at the eighth-grade level than at the fifth-grade level. Almost 28 percent of eighth-grade teachers work in schools where students were assigned to classes by ability, compared to only 10 percent of fifth-grade teachers. Ability grouping was equally common in middle schools in which the typical eighth-grade student was taking pre-algebra or algebra and in middle schools where the typical eighth-grade student was taking general mathematics. Ability grouping was not associated with differences in KIRIS gain scores at either grade level.

Ability grouping may also occur within classes, but for the majority of teachers at both grade levels it was not a frequent occurrence. Although a slight majority of teachers group students by ability in their classes at least occasionally, only about one-fourth of the teachers at either grade level indicated that they group students by ability "often" or "always." Interestingly, fifth-grade teachers in low-gain schools were more likely to use ability grouping than their peers in high-gain schools. At the fifth-grade level, 38 percent of teachers in low-gain schools reported that they "often" or "always" grouped students by ability, while only 12 percent of teachers in high-gain schools did so. This difference did not appear in eighth grade.

Individualized instruction and small group instruction occurs with similar frequency in both grade levels. On average, teachers reported that they taught mathematics to the whole class 43 percent of the time; they divided students into small groups (2-5 students) for mathematics about 36 percent of the time; and they worked with students individually about one-quarter of the time. This pattern was similar for teachers in low-gain and high-gain schools.

Professional Development and Preparedness

Teachers at both grade levels participated regularly in professional development in the areas of mathematics instruction and assessment. Teachers reported that they benefited from the training they received, and they expressed confidence in their ability to teach mathematics. There was little or no difference in professional development or preparedness between teachers in high-gain and low-gain schools at either grade level.

Almost all of the teachers surveyed had participated in formal professional development activities in the current school year (97 percent) as well as in each of the past two years (97 percent and 96 percent for 1995-96 and 1994-95, respectively). In addition, during the last three years, 24 percent of the fifth-grade teachers and 39 percent of the eighth-grade mathematics teachers acted as trainers for professional development in mathematics.

Teachers participated in professional development that focused on instructional goals and outcomes, mathematics curriculum, and the KIRIS assessments. Overall, two-thirds or more of the teachers participated in professional development that focused "a moderate amount" or "a great deal" on the following topics: mathematics curriculum and instruction (77 percent), KERA goals and outcomes (76 percent), preparing students for the KIRIS assessments (71 percent), and preparing students for mathematics portfolios (68 percent). In contrast, fewer than one-half participated in professional development that focused strongly on the following topics: classroom assessment methods (41 percent), curriculum and instruction in other subjects (40 percent), use of educational technology (38 percent), and Language Arts curriculum and instruction (32 percent).[9]

Teachers in both grades indicated that the professional development they received helped them with their mathematics teaching. Specifically, the majority of teachers reported that professional development helped them either "a moderate amount" or "a great deal" to improve their ability to: help students with their mathematics portfolios (71 percent and 58 percent in fifth and eighth grade, respectively), prepare for KIRIS open-response items in mathematics (57 percent and 69 percent in fifth and eighth grade, respectively), and use manipulatives to teach mathematics (61 percent and 52 percent in fifth and eighth grade, respectively). In addition, 51 percent of the fifth-grade teachers indicated that professional development helped them to teach mathematical communication (compared to 36 percent of the eighth-grade mathematics teachers).

Fifth-grade teachers and eighth-grade mathematics teachers expressed high levels of confidence in their preparedness to teach a variety of mathematics topics. Table 4 shows the percent of teachers in each grade level who felt "fairly well prepared" or "very well prepared" to teach the topics in the Kentucky mathematics curriculum. The vast majority of teachers in both grades felt prepared to teach most of the topics, but only a small majority felt prepared to teach technology. Fewer fifth-grade teachers than eighth-grade teachers felt prepared to teach statistics and probability and algebraic ideas, although this is part of the elementary curriculum in Kentucky.

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[9] As one might anticipate, there were differences between fifth-grade teachers and eighth-grade mathematics teachers in participation in professional development on Language Arts curriculum and instruction. Forty-nine percent of fifth-grade teachers participated in this type of training compared to 15 percent of eighth-grade mathematics teachers.

Table 4

Teacher Preparation for Mathematics Topics (Percent of Teachers Who Were "Fairly Well" or "Very Well" Prepared)

Topic	Fifth Grade	Eighth Grade
Numbers and computation	94	96
Geometry and measurement	86	94
Statistics and probability	52	86
Algebraic ideas	54	93
Connections among mathematical ideas	82	94
Connections between mathematics and other subjects	81	84
Problem solving	86	96
Mathematical communication	81	92
Reasoning	79	89
Technology (calculators and computers) in support of mathematics	52	62

There were mild associations between KIRIS gains and teacher preparedness. In fifth grade, a larger percentage of teachers from high-gain schools than low-gain schools expressed confidence in their preparation to teach algebraic ideas (67 percent compared to 49 percent). Similarly, at eighth grade, a larger percentage teachers in high-gain schools than in low-gain schools felt prepared to teach statistics and probability (94 percent compared to 73 percent).

Curriculum Emphasis

We asked somewhat different questions about curriculum emphasis to fifth- and eighth-grade teachers. Those fifth-grade teachers who taught all subjects were asked about their allocation of instructional time across subject areas and the degree to which they integrated mathematics with other subjects. Eighth grade teachers were asked about the degree to which they work with teachers in other subject areas. Both fifth- and eighth-grade teachers were asked about their allocation of instructional time to various aspects of mathematics.

Allocation of Instructional Time Across Subjects[10]

Originally, the KIRIS assessments in all subjects were given in fourth grade (in elementary schools). However, this created too great a burden on fourth-grade students and teachers, so the assessments were divided between grades four and five. Fourth-grade students are tested in reading, writing and science. Fifth-grade students are tested in mathematics, social studies, arts and humanities, and practical living/vocational studies. This change occurred in 1996-97. We were interested in the impact of the KIRIS assessments on the allocation of instructional time, and whether there was an association between the subjects that were assessed and the subjects emphasized by teachers.

Fifth-grade teachers, who teach all subjects, reported devoting as much time to mathematics as to reading. Writing, social studies and science received somewhat less instructional time, and teachers devoted the least time to Arts & Humanities and Practical Living/Vocation Studies (see Table 5). In addition, they reported that instructional time had stayed the same or increased in almost all cases. However, teachers were more likely to report increases in subjects associated with KIRIS than in other subjects.

Two-thirds of the fifth-grade teachers reported increasing the amount of instructional time they spend on mathematics (and none of the teachers reported a decrease in time spent on mathematics). More than one-half of the teachers also increased the amount of time they devoted to writing, Arts and Humanities, and Practical Living/Vocational Studies. Although the writing assessment remained in grade 4, it is not surprising that fifth-grade teachers increased writing instruction as the KIRIS assessments in all subject areas require a great deal of writing, particularly the mathematics portfolios. Social studies was the only subject area tested in fifth grade for which a majority of the teachers did not report an increase. There were only two subjects for which a substantial number of fifth-grade teachers reported a decrease in instructional time. Eighteen percent of fifth-grade teachers said they reduced the time devoted to reading and 10 percent reduced the time devoted to science.

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[10] Thirty-two percent of fifth-grade teachers indicated that they did not teach all subjects and skipped the questions about the allocation of instructional time across subjects. Thus, they were excluded from the results reported in this section.

Table 5

Fifth-Grade Subject Coverage and Change in Coverage (Percent of Teachers Reporting Increase in Coverage During Past Three Years)

Subject	Median Hours per Week	Percent Increasing Coverage
Mathematics*	5	66
Writing	4	61
Arts and Humanities*	2	58
Practical Living/Vocational Studies*	1	52
Science	4	39
Social Studies*	4	36
Reading	5	10

* Denotes subject tested in KIRIS in grade five; other subjects are tested in grade four.

Some caution is warranted in interpreting the results regarding total class time per subject, although there is little reason to question the relative changes in time among subjects. Seventy-nine percent of teachers reported an increase in class time for at least one subject, but only 26 percent reported a decrease in class time for any subject. In fact, many teachers reported increasing the time they devoted to *all* subjects. The case studies of exemplary teachers conducted as part of this research provide two possible explanations for this increase. One possibility is that by integrating subjects teachers increase the class time they devote to each; the other possibility is that teachers have increased students' overall time on task by reducing non-academic classroom activities.

We collected additional information about the integration of mathematics with other subjects. Fifth-grade teachers reported that they often integrated mathematics with other subjects and that the frequency of integration has increased. The vast majority of teachers reported integrating mathematics with each of the following subjects at least once a month: reading (85 percent); writing (95 percent); social studies (77 percent); and science (92 percent). In fact, the majority of teachers (67 percent) reported integrating mathematics with writing at least once a week, which may be due to the mathematics portfolios.

For each subject area we asked about, except arts and humanities, at least one-half of the teachers reported that they have increased the frequency with which they integrate the subject with mathematics (reading 58 percent, writing 73 percent, social studies 50 percent, science 53 percent, and practical living/vocational studies 50 percent). There were no consistent differences between fifth-grade teachers in high-gain and low-gain schools in the frequency of integrating mathematics with other subjects.

Allocation of Instructional Time within Mathematics

There has been considerable change in emphasis within mathematics at both grade levels. Overall, 80 percent of the teachers reported that the content of their mathematics teaching had changed either a moderate or a major amount during the past three years; not a single teacher reported no change. Numbers and computation receives the greatest share of class time in both fifth and eighth grades with 95 percent of teachers reporting that they cover the content area at least once a week (see Table 6). In fifth grade, no other content area is covered as frequently. However, in eighth grade, 80 percent of the teachers reported covering algebraic ideas at least once a week.

Table 6

Frequency of Mathematics Content Area Coverage (Percent of Teachers Who Covered Content at Least Once a Week)

Content area	Fifth Grade	Eighth Grade
Number and computation	95	95
Geometry and measurement	39	39
Algebraic ideas	30	80
Statistics and probability	13	24

Table 7 shows the change in the frequency with which content areas are covered. More than one-half of the teachers in both grades increased the time devoted to statistics and probability and to algebraic ideas.

Table 7

Change in Mathematics Content Area Coverage (Percent of Teachers Who Increased Coverage During the Past Three Years)

Content area	Fifth Grade	Eighth Grade
Number and computation	10	20
Geometry and measurement	46	44
Statistics and probability	61	54
Algebraic ideas	59	54

At both grade levels teachers from high-gain schools reported a higher frequency of coverage in "algebraic ideas" than did teachers from low-gain schools (45 percent vs. 25 percent for fifth-grade and 88 percent vs. 60 percent for eighth-grade teachers). In eighth grade, a greater percentage of teachers in high-gain schools than low-gain schools reported increasing their coverage of all four mathematics topics. For example, 75 percent of teachers from high-gain schools increased coverage of "statistics and probability," compared to only 40 percent of teachers from low-gain schools. Surprisingly, in fifth grade more teachers from low-gain schools than high-gain schools increased their frequency of teaching "statistics and probability" (69 percent and 46 percent, respectively). However, since few fifth-grade teachers covered this content on a regular basis, these differences should not be over-interpreted.

Instructional Practices

Teachers identified themselves with standards-based approaches to teaching mathematics, and they used both traditional and standards-based strategies for teaching. They also assigned both types of activities for students. Traditional approaches were somewhat more common, and used more frequently. However, during the past three years a large majority of teachers increased their use of standards-based approaches. There were few differences between elementary and middle schools in this regard, and there was little relationship between instructional practices and KIRIS gains in the second biennium.

Philosophy and Approach to Teaching Mathematics

Teachers characterized their overall approaches to teaching mathematics on four dimensions defined by contrasting statements: one end of each dimension was more consistent with a standards-based approach; the other with a traditional approach. The four dimensions concerned goals for students, philosophy of instruction, the content of mathematics, and the order of presentation. Teachers indicated whether they emphasized thinking and questioning mathematically vs. mastering the content of mathematics, learning terms and computation vs. conceptual understanding, in-depth study of a few topics vs. comprehensive coverage of many topics, and teaching facts before principles vs. teaching principles before or simultaneously with facts. Each dimension had five levels, including one that was midway between the two descriptors. Teachers marked one of five points that reflected their approach.

On three of the four dimensions, between one-half and two-thirds of the teachers rated themselves closer to the standards-based end of the continuum. For example, 77 percent of fifth-grade teachers and 68 percent of eighth-grade mathematics teachers placed their approach closer to the statement that a teacher should primarily "encourage students to think and question mathematically" than to the statement that a teacher should primarily "transmit the knowledge and content of mathematics." One-half or more of the teachers at both grade levels also identified more closely with conceptual understanding than with learning mathematical terms and computation, and with teaching principles before (or with) facts than with teaching facts before principles.[11] On the fourth dimension—depth vs. breadth—the largest number of teachers rated themselves midway between the two extremes. There were no significant differences in overall teaching approach between teachers in high-gain and low-gain schools.

Teachers' responses were similar when they were asked more specific questions about their teaching methods. They indicated support for both traditional and standards-based activities. For example, more than 98 percent agreed with the traditional idea that students require a good deal of practice to become competent in mathematics. Similarly, more than 75 percent agreed that students must learn facts, principles, and formulas, and that they should always show their work. However, all of the teachers also agreed with the standards-based viewpoint that different students learn to solve problems in different ways, 65 percent agreed that good teachers create their own lessons and materials, and more than three-quarters disagreed that "teachers should follow the mathematics textbook."

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[11] Among fifth-grade teachers, 54 percent placed themselves closer to conceptual understanding while five percent placed themselves closer to mathematical terms and computation. Forty-two percent placed themselves midway between the two ends. Fifty eight percent aligned themselves more with teaching principles before (or with) facts, compared to 15 percent who supported teaching facts before principles. Among eighth-grade teachers, 53 percent were closer to conceptual understanding compared to eight percent who were closer to mathematical terms and computation; 53 percent were more aligned with teaching principles before (or with) facts compared to 19 percent who placed themselves closer to teaching facts before principles.

These results show that the standards-based and traditional approaches are not mutually exclusive in teachers' minds. They endorse practices associated with each approach. However, teachers also revealed some uncertainty about how to integrate the two approaches in particular circumstances. For example, Table 8 shows teachers' responses to four questions about the degree to which students should be left to puzzle things out for themselves. The large majority of teachers agreed with the four statements, although the statements carry somewhat contradictory messages. On the one hand, teachers endorsed the notion that students should be allowed to figure things out for themselves. On the other hand, they believed students should be given step-by-step instructions and should have their errors corrected quickly, which would preclude some students from solving problems on their own. There were strong similarities on

Table 8

Teachers' Opinions About Student Learning in Mathematics (Percent of Teachers Who Agreed with Statement)

	Fifth Grade		Eighth Grade	
Statement	Somewhat Agree	Strongly Agree	Somewhat Agree	Strongly Agree
Students' errors should be corrected quickly so they do not finish a lesson feeling confused or stuck	27	62	43	42
Students should receive step by step directions to aid in problem solving	49	28	44	27
Teachers should not necessarily answer students' questions, but should let them figure things out themselves	75	16	65	17
Students learn best if they have to figure things out for themselves instead of being told or shown what to do	53	26	51	20

these questions between the responses of fifth- and eighth-grade teachers, and between teachers in high-gain and low-gain schools.

Expectations for Students

A key assumption of the KERA reform is that all students can learn to high levels. While teachers endorse higher expectations for students, in general, they do not believe that all students can learn to the *same* high levels. Moreover, they agree that too much pressure can squelch students' enthusiasm for mathematics. Table 9 shows that two-thirds of the teachers believe students can learn more than they have been expected to learn in the past. However, only about one-half believe all students can learn mathematics at grade level, and about two-thirds of the teachers agreed that there are some students who will never perform above the level of Novice.[12]

Table 9

Teachers' Expectations for Students (Percent of Teachers Who Agreed "Somewhat" or "Strongly" with Statement)

Statement	Fifth Grade	Eighth Grade
All students can learn more than we have been teaching them in the past	67	73
There are some students who will never perform above the level of Novice, no matter how much effort the teacher devotes to them	63	70
I believe all students can learn fifth [eighth] grade mathematics by the end of fifth [eighth] grade	48	48
Teachers should use the same standards in evaluating the work of all students in class	35	45

It is likely that the kinds of interventions that help students move from Novice work to Apprentice work are different than the kinds of interventions that help them move from Apprentice to Proficient or from Proficient to Distinguished. The majority of fifth-grade teachers (59 percent) reported that moving students from Proficient to Distinguished is more difficult than moving students up from other levels. Forty percent of eighth-grade teachers agreed that moving students from Proficient to Distinguished is most difficult. However, one-quarter of the eighth-grade teachers reported that all of the steps are equally difficult, while only 10 percent of fifth-grade teachers responded this way.

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[12] Student performance is assigned to one of four categories: Novice, Apprentice, Proficient, and Distinguished.

Teachers appear to be trying to find a balance between high expectations and putting too much pressure on students. Eighty-two percent agreed that teachers in their school push students fairly hard in academic subjects. The majority (70 percent) also agreed that too much pressure can cause students to lose their enthusiasm for mathematics. Overall, there were no differences in expectations between the grade levels or between teachers in high-gain or low-gain schools.

Teaching Strategies

Teachers reported regular use of both traditional and standards-based teaching strategies in mathematics, and they generally reported an increase in the frequency of standards-based practices (see Table 10). More than 80 percent of the fifth-grade teachers used four of the eight strategies at least weekly, and more than one-half used seven of the eight at least weekly. The pattern was similar for eighth-grade teachers, but there were some differences. Fifth-grade teachers were more likely to ask open-ended questions and show connections between

Table 10

Use of Teaching Strategies (Percent of Teachers Who Used Strategy at Least 1-2 Times per Week and Percent Who Increased Use During Past Three Years)

	Fifth Grade		Eighth Grade	
Strategy	Weekly Use	3-year Increase	Weekly Use	3-year Increase
Traditional approaches				
Demonstrate how to perform a new mathematics skill	96	18	91	17
Explain correct solutions to assigned problems	89	16	100	9
Explain a new concept	80	18	78	14
Give tests or quizzes	42	4	46	6
Standards-based approaches				
Ask open-response questions with many right answers	61	88	44	70
Give examples of real-world applications of mathematics skills	91	46	83	46
Demonstrate mathematical ideas using objects, constructions, etc.	55	53	61	41
Show connections between mathematics and other subjects	68	33	55	39

mathematics and other subjects than eighth-grade teachers (61 vs. 44 percent, and 69 vs. 55 percent, respectively).

At both grade levels, the greatest increases in use occurred for the four standards-based strategies. For example, the vast majority of teachers increased their emphasis on open-response questions with many right answers. About one-half of the teachers also increased their use of real-world applications, demonstrations using objects, and connections with other subjects. So, although traditional approaches continued to be used on a regular basis, the greatest change in practice was in the direction of standards-based approaches.

The largest difference in teaching strategies between teachers in low-gain and high-gain schools was in the area of testing. A greater percentage of eighth-grade mathematics teachers from high-gain schools (80 percent) than low-gain schools (35 percent) gave tests or quizzes at least once a week. The difference was smaller, among fifth-grade teachers. Forty-one percent of teachers in high-gain schools gave tests at least weekly compared to thirty percent of teachers in low-gain schools.

In addition to questions about general mathematics teaching strategies, we asked teachers about three specific instructional scenarios: how teachers allocate time across subtopics within the general theme of graphing, how teachers would respond to errors made by students while working at the board on computations with fractions, and how teachers would begin and end an instructional unit on summarizing data. These three topics were selected because they are part of the normal curriculum at both grade levels and are consistent with the learning outcomes delineated in the Kentucky transformations and the core concepts for mathematics. Teachers' reports about specific mathematics instructional activities revealed considerable uniformity of practices across grade levels and between high-gain and low-gain schools within a grade level.

Both fifth- and eighth-grade teachers reported that they gave graphing considerable attention.[13] In both grades, teachers spent 20 class hours (on average) and assigned about 12 homework assignments (on average) dealing with graphing (and data displays). Most teachers in both grades reported that a moderate or a great deal of time was spent on "traditional" graphing activities, including producing graphs (of different types) and collecting data and displaying it in graphs (see Table 11). In fifth grade, most teachers also devoted a moderate amount or a great deal of time to three of the four activities that are consistent with the standards-based approach of KERA. In eighth grade, the majority of teachers devoted a moderate or a great deal of time to two of the four standards-based activities.

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[13] Considerable attention was paid to "graphing" in fifth grade and "graphing and data displays" in eighth grade.

Table 11

Classroom Activities Involving Graphing (and Data Display) (Percent of Teachers Who Devoted a "Moderate Amount" or "A Great Deal" of Time to Activity)

Activity [grade level]	Fifth Grade	Eighth Grade
Traditional approaches		
Producing bar graphs and pie (circle) graphs [5]; producing tables and graphs (line graphs, box and whisker plots, etc.) [8]	74	82
Collecting data and displaying it in graphs [5]; collecting data, selecting an appropriate format and producing a table or graph [8]	75	76
Standards-based approaches		
Interpreting graphs from different sources (e.g., newspapers and magazines)	70	41
Producing graphs for assignments in other subjects (e.g., social studies)	62	39
Solving word problems in which important information is contained in graphs	78	57
Constructing graphs or data displays using objects, construction papers, etc.	41	50

In both grades teachers in low-gain schools reported spending somewhat more time on graphing (and data displays) than teachers in high-gain schools. The typical (median) teacher in a low-gain school spent about 20 class periods on graphing while the typical teacher in a high-gain school spent about 15. In eighth grade the emphasis on graphing was related to the mathematics course taken by the typical student. In schools where the average eighth-grade student enrolled in pre-algebra or algebra (based on teachers' reports), the typical teacher spent 13 periods on graphing. In schools where the average eighth-grade student enrolled in eighth-grade mathematics, the typical teacher spent 20 periods on graphing.

The relative emphasis on different aspects of graphing was similar for teachers in high- and low-gain schools. This was true for all the activities identified as "traditional" and most of those identified as "non-traditional." The only exceptions were "constructing graphs or data displays using objects" in fifth grade (39 percent of teachers in low-gain schools spent a moderate amount of time or a great deal of time on this compared to 56 percent in high-gain schools) and "solving word problems in which important information is contained in graphs" in eighth grade (45 percent of teachers in low-gain schools devoted a moderate or great deal of time to this compared to 77 percent of teachers in high-gain schools).

The second instructional activity we addressed was responding to student errors; specifically we asked teachers how they would react in a hypothetical situation in which a student made a mistake while working at the board. For example, fifth-grade teachers responded to the following situation:

> Imagine you have been teaching a unit on *reducing fractions to lowest* terms for about a week. You ask for volunteers to come to the board to write 18/24 in lowest terms. A student of average ability comes to the board and writes 18/24 = 9/12. How likely are you to respond in the following ways?[14]

The pattern of responses to these situations was almost identical across the grade levels, with teachers preferring, in order, actions that drew information from the students at the board, from other students in class, and, least frequently, providing information themselves.[15] Table 12 shows the percentage of teachers in each grade indicating they were "somewhat likely" or "very likely" to take each action. Almost all teachers said they would be most likely to respond in ways that drew information from students. For example, most teachers reported it was likely that they would ask the student another question to lead to the answer or that they would call on other students to help out. This is consistent with the "student-centered" approach embodied in KERA. Although they were less frequent, responses in which the teacher supplied the missing information were also common. For the most part, there were only minor differences between grade levels, and, within grade levels, there were only minor differences between teachers in low-gain and high-gain schools.

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[14] Eighth-grade teachers responded to a similar hypothetical situation in which the problem involved dividing by a fraction. On the eighth-grade survey, the student's solution to the problem 1/2 ÷ 1/4 is correct but the student remarks, "That's wrong. The answer is larger than the numbers I started with, but division is supposed to give smaller answers."

[15] The response options were similar for fifth- and eighth-grade teachers with only minor changes reflecting the differences in problems.

Table 12

Responding to Student Errors (Percent of Teachers Who Were "Somewhat Likely" or "Very Likely" to Respond in a Given Manner)

Teacher response [grade level]	Fifth Grade	Eighth Grade
Focus on student at the board		
Ask student to explain his/her reasoning	95	95
Ask student another question to lead to the answer	92	99
Suggest a concrete method (suggest drawing a picture of fractions [5]; suggest using blocks or objects to solve [8])	41	60
Involve other students		
Ask all the students if they agree with answer	81	86
Ask other students how one could check the answer	76	76
Obtain different responses from students and discuss which is correct	70	70
Ask other students about reasons for error	—	72
Have all students work problem on own	52	—
Thank the student and call on another for a different solution	24	6
Provide information themselves		
Point out the error (indicate 9/12 is not in lowest terms [5]; explain that when dividing by 1/4 the quotient should be larger [8])	63	42
Review relationship between multiplication and division	—	71

The third aspect of instruction teachers described was strategies for beginning and ending a new curriculum unit. Teachers indicated how they would initiate a unit on the topic of summarizing data (averages in fifth grade, measures of central tendency in eighth grade) and what sort of culminating activity they would use. Options included "traditional" activities, such as teaching the procedures for computing averages and giving a test, as well as "reform-oriented" activities, such as posing a problem and assigning a portfolio prompt.

Fifth-grade teachers were more likely to begin the unit in "non-traditional" ways than traditional ways. For example, 80 percent of fifth-grade teachers were "somewhat likely" or "very likely" to begin the unit by discussing the concept of average as it applies in another subject. Similarly, about 70 percent were likely to give a problem whose solution involves an average or ask students to estimate a typical quantity (see Table 13). The computational approach ("explain how to compute an average") was the fourth most likely strategy for initiating the unit. In comparison, eighth-grade mathematics teachers were about equally likely to adopt the traditional approach ("Explain the difference between mean, median, and mode and how to calculate each") as they were to adopt a non-traditional approach ("have students graph features of their classmates" or "have students graph features of their classmates and discuss the differences between the graphs").

Table 13

Beginning a Curriculum Unit (Percent of Teachers Who Were "Somewhat Likely" or "Very Likely" to Respond in a Given Manner)

Teacher response [grade level]	Fifth Grade	Eighth Grade
Traditional approaches		
Explain how to compute an average [5]; explain the difference between mean, median and mode and how to calculate each [8]	55	78
Standards-based approaches		
Discuss the concept of average as it applies in another field [5]; discuss measures of central tendency as they apply in another subject [8]	80	69
Pose a problem that can be solved using averages [5]; pose a related, open-ended problem that involves measures of central tendency [8]	72	74
Have students estimate the shoe size of a typical student (or some similar quantity) [5]; have students graph features of their classmates and discuss the differences between the graphs [8]	68	83
Give students four towers of blocks and ask them to re-arrange the blocks to even out the towers	51	—
Show students a graph of the height of various buildings and ask what is typical [5]; show students a table of information about enrollments in Kentucky middle schools and ask what is typical [8]	48	54
Have students draw bar and line graphs and identify mean, median and mode	—	69
Ask students to write a story describing the "typical" student	—	28

The difference between fifth-grade teachers and eighth-grade mathematics teachers is reinforced if we concentrate only on the strategies teachers are "very likely" to use. Over one-half of the eighth-grade teachers are very likely to begin the unit using the traditional approach (54 percent) compared to one-third of the fifth-grade teachers (33 percent). Within grade levels there were only minor differences between teachers in low-gain and high-gain schools.

At the end of the hypothetical unit on averages most teachers said they would have a culminating assessment activity, and most of these were consistent with the assessment components of KIRIS. Fifth-grade teachers were likely to assign a set of open-response questions (92 percent) or assign a portfolio prompt (87 percent). Many fifth-grade teachers were also likely to assign a set of exercises (71 percent) or to give a test (67 percent). Only 10 percent said they were likely to end the unit without a special culminating activity. Eighth-grade mathematics teachers were more likely to end the unit by assigning a portfolio prompt (92 percent) or giving a test (86 percent).[16] About one-half of the eighth-grade mathematics teachers said they were likely to end the unit with a set of exercises; fewer than five percent said they would have no special culminating activity.

There was one substantial difference between eighth-grade mathematics teachers in high-gain and low-gain schools concerning culminating activities for a unit on measures of central tendency. A greater percentage of mathematics teachers in high-gain schools (98 percent) were likely to give a test than were mathematics teachers in low-gain schools (72 percent).

Student Learning Activities

Teachers ask students to do both traditional and standards-based learning activities regularly, but they have increased the frequency with which students do things consistent with the standards-based approach. The most common activities across the grade levels were practicing computation skills, working problems from the textbook, explaining why students solved a problem a certain way, and using calculators and computers to solve mathematics exercises (see Table 14).

The majority of teachers in both grade levels increased the frequency of most standards-based activities while maintaining the frequency of traditional activities. For three traditional activities, a substantial percentage of teachers reported a decrease in the frequency of the activity: Thirty-five percent of teachers decreased the amount of time they spend on working problems from the textbook; 30 percent cut back on the amount of time dedicated to memorizing mathematics facts, rules, or formulas; and another 18 percent reduced time spent on practicing computation skills.

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[16] Eighth-grade mathematics teachers were not asked about assigning open-response questions.

Table 14

Student Learning Activities (Percent of Teachers Who Assigned Activity at Least 1-2 Times per Week and Percent Who Increased Use During Past Three Years)

Activity	Fifth Grade Weekly Use	Fifth Grade 3-year Increase	Eighth Grade Weekly Use	Eighth Grade 3-year Increase
Traditional approaches				
Practice computation skills	97	6	86	11
Work problems from the textbook	83	3	79	6
Memorize mathematics facts, rules or formulas	33	7	33	9
Standards-based approaches				
Explain why they solved a problem a certain way	73	57	70	53
Use mathematics to solve real-world problems	73	56	64	39
Use calculators or computers to solve exercises	65	68	91	47
Write about mathematics	61	82	41	65
Represent concepts or ideas in tables, graphs or pictures	53	56	37	49
Solve problems using manipulatives	54	63	40	56
Use mathematics in the content of [5], integrate mathematics with [8] other subjects	46	44	24	37
Use measuring tools in mathematics	37	29	30	30
Discover mathematics concepts for themselves	35	38	27	42
Solve non-routine problems	29	59	27	36
Work on extended mathematics activities that take several days	27	65	10	48

Table 14 is also notable for the consistency in reported practice between grade levels. For the most part, fifth and eighth-grade teachers reported engaging students in various activities at similar levels. There were a few exceptions, some of which may be explained by differences in the content and organization of the curriculum in the two grades. For example, the biggest difference was in the use of calculators or computers to solve exercises, with eighth-grade teachers more likely than fifth-grade teachers to engage in that activity at least weekly (91 percent compared to 65 percent). The other differences were in the frequency of writing about mathematics and the frequency of working on extended mathematics activities. Forty-one percent of eighth-grade teachers compared to 60 percent of fifth-grade teachers had students write about mathematics at least weekly. The comparable figures for extended mathematics activities were 10 percent in eighth grade compared to 27 percent in fifth grade. There were no sizable differences in the frequency of student learning activities between teachers in high-gain and low-gain schools in either grade level when comparing use on a weekly basis. However, in eighth grade, there were differences between high-gain and low-gain schools in the percent of teachers who used certain learning activities on a daily basis. Mathematics teachers in high-gain schools were more likely to have students practice computation skills on daily basis than teachers in low-gain schools (67 percent compared to 39 percent), and they were more likely to have students use calculators or computers to solve exercises on a daily basis, as well (53 percent compared to 32 percent).

Influences on Practice and Support for Change

KIRIS

Teachers were divided in their appraisal of the effects of KIRIS on mathematics instruction. About one-half of the teachers (54 percent) said that KIRIS had a negative impact compared to about one-third (36 percent) who felt KIRIS has had a positive effect. This pattern was similar for fifth- and eighth-grade teachers.

However, there were differences in the responses from eighth-grade teachers in high-gain and low-gain schools. Eighth-grade teachers in schools where the mathematics scores had increased the most during the second biennium were much more positive about the impact of KIRIS than teachers in schools where the scores had decreased or increased only a small amount. Forty-six percent of the eighth-grade mathematics teachers in high-gain schools felt that KIRIS had a positive impact on their school's mathematics program compared to only 19 percent of teachers in low-gain schools. This difference did not occur among fifth-grade teachers in high-gain and low-gain schools.

Conversely, most teachers do not believe that their school's mathematics program has produced broad improvements in student learning that have a large impact on KIRIS scores. Teachers who reported that their schools' KIRIS mathematics scores had increased during the second biennium identified the factors that contributed "a great deal" to the score gain. Table 15 compares the responses of teachers in 1996-97 (after score gains from the second biennium had been reported) to the responses of teachers in 1994-95 (Koretz et al., 1997).[17] Although the factors thought by most teachers to contribute "a great deal" to KIRIS gains have changed, what has not changed is the belief that gains are not associated strongly with improvements in students' mathematics knowledge and skills. In 1996-97, the majority of fifth-grade teachers and eighth-grade mathematics teachers reported that differences between cohorts of students had "a great deal" of influence on their schools' gain in scores. A lower percentage of the teachers reported that testwiseness (including familiarity, test-taking skills, and practice tests) contributed a great deal to score gains. Only a small percentage of teachers thought that their school's KIRIS mathematics gains could be attributed to improved knowledge and skills—either the specific skills emphasized by KIRIS (8 percent) or mathematics knowledge and skills more broadly (8 percent). Presumably teachers have greater experience with KIRIS in 1996-97 than they did in 1994-95. Many appear to believe that factors outside their control (i.e., differences between students) have a stronger influence on score gains than factors within their control. Even within the domain of their classroom, teachers think that scores are more a function of test taking skills and specific test preparation activities than improvements in students' knowledge of mathematics.

One possible explanation for these results is that students are coming into fifth grade and eighth grade with greater knowledge of mathematics, i.e., KERA has had a positive effect in the earlier grades. Fifth-grade teachers and eighth-grade mathematics teachers might describe this situation in terms of better students rather than better preparation. However, if this were the case, one would expect them to attribute more of the gains to mathematics knowledge and skills, which they do not do.

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[17] The results represent the combined responses of teachers in the mathematics accountability grades in elementary and middle schools (fifth-grade teachers and eighth-grade mathematics teachers in 1996-97; fourth-grade teachers and eighth-grade mathematics teachers in 1994-95).

Table 15

Reasons for KIRIS Score Gains in Mathematics (Percent of Teachers Who Reported that Each Factor Contributed "A Great Deal" to KIRIS Score Gains in their School)

Factor	1996-97	1994-95
Improved student test taking skills	12	34
Increased student motivation	5	16
Differences between groups of students from one year to the next**	56	26
Broad improvements in students' mathematics knowledge and skills*	8	16
Specific improvements in student mastery of mathematics knowledge and skills emphasized by KIRIS**	8	24
Increased student familiarity with the KIRIS mathematics assessments*	18	55
Students' work with practice tests and other preparation materials in mathematics*	10	51

* The words "student(s)" and "mathematics" were added to these items in 1996-97.

** Other minor wording changes were to these items.

State and Local Support for Reform

Over the past few years, the Kentucky Department of Education has invested large amounts of resources in support of educational reform in Kentucky. KDE has developed academic expectations, created and improved KIRIS, developed supportive curriculum materials, sponsored workshops on scoring and using KIRIS assessments, and provided extensive opportunities for professional development. Other agencies, such as Kentucky Educational Television, local school districts, and individual schools, have also contributed to the effort to promote reforms consistent with KERA. Kentucky teachers have had access to a wealth of relevant information and support.

Teachers found that some factors had a greater influence than others on the content of their mathematics lessons and the methods they used to teach mathematics. We asked about seventeen different items that were grouped into four broad clusters: curriculum guides and textbooks, assessments, school staff, and professional development. We asked separately about the influence of these items on what they teach and how they teach. In general, teachers responded similarly to these two questions, so we have chosen to present only the results for factors that influence what they teach.

Five of the 17 items had "a great deal of influence" on what was taught by more than one-half of the teachers. These included three curriculum documents: *Transformations* (KDE, 1995a), *Core Content for Mathematics Assessment* (KDE, undated), and *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989) and two assessment-related items: the KIRIS mathematics portfolio, and the KIRIS open-response mathematics items. Almost three-quarters of teachers reported that *Core Content for Mathematics Assessment* had a great deal of influence over the content of their teaching compared to about 50 percent for the other two curriculum documents. Sixty-six percent of teachers said the KIRIS open-response mathematics items had a great deal of influence on the content of their teaching, as did 57 percent regarding the KIRIS mathematics portfolio.

District curriculum guides, supplemental mathematics materials, and "other" professional development were the next most influential, exerting a great deal of influence on what was taught for 30 percent to 40 percent of the teachers. The "other" professional development category included anything other than PRISM training and cluster leader training, and we do not know exactly which professional development opportunities teachers were reporting.

The least influential factors were school staff (including district curriculum specialists, principal or assistant principal, school resource teacher or cluster leader, and other teachers) and specific professional development (including PRISM training and cluster leader training). Overall, only about 10 percent of teachers said that the district curriculum specialist and principal or assistant principal had a great deal of influence over the content of their teaching while slightly more than one-half of the teachers said they had little or no influence. Nineteen percent of respondents reported that "other teachers" had a great deal of influence over course content, while 36 percent said that other teachers had little or no influence over what they taught. Similarly, PRISM training and cluster leader training did not appear to have substantial influence for many teachers. Only about 11 percent of teachers said PRISM training had a great deal of influence over the content and style of their mathematics teaching, and only 24 percent of teachers indicated that cluster leader training had a great deal of influence over their mathematics content and teaching strategy.[18]

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[18] However, these figures for cluster leader training and PRISM training may be misleading because these forms of support were not readily available to all teachers. For example, there was one

There were only minor differences between fifth- and eighth-grade mathematics teachers in the influence of these factors. For example, in middle schools, a supportive professional environment was associated with higher gains. Specifically, a greater percentage of eighth-grade mathematics teachers in high-gain schools than in low-gain schools (42 percent compared to 0 percent) reported that school staff (including district curriculum specialists, school principals, and other teachers) had a strong influence on their teaching of mathematics. In addition, a greater percent of teachers from high-gain schools than low-gain schools (29 percent compared to 5 percent) reported that the principal or assistant principal had a great deal of influence on the content of their curriculum. Similarly, the district curriculum specialist had a great deal of influence on 25 percent of the teachers in high-gain schools compared to none of the teachers in low-gain schools.

Similarly, some curriculum materials were more influential among eighth-grade mathematics teachers in high-gain than low-gain schools. Sixty-five percent of eighth-grade mathematics teachers in high-gain schools said the NCTM *Standards* had a great deal of influence over content and teaching strategy compared to 37 percent of eighth-grade mathematics teachers in low-gain schools. Similarly, a greater percentage of eighth-grade mathematics teachers from high-gain schools than low-gain schools (45 vs. 16 percent) indicated that supplementary mathematics materials had a great deal of influence over their teaching strategies.

Textbooks

The alignment of textbooks with curriculum is important, because mathematics teachers rely on textbooks for a large portion of their assignments. About 10 percent of teachers draw almost all their mathematics assignments (76 percent-100 percent) from their textbooks. Roughly one-third of teachers obtain more than one-half of their assignments (between 51 percent and 75 percent) from textbooks. Another one-third obtain between 26 percent and 50 percent of their assignments from textbooks, and the remainder, 23 percent, use textbooks for less than one-quarter of their assignments. Teachers also rely on

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cluster leader for each 20 teachers. In rural parts of the state, cluster leaders could be an hour's drive away from the teachers they were supposed to support, and this distance might greatly diminish their effectiveness. Similarly, PRISM training was only available in some areas of the state.

supplemental books and materials. About three-quarters of the teachers used supplemental materials at least once a week.

The large majority of fifth- and eighth-grade teachers indicated that textbooks supported the mathematics curriculum well in the areas of number and computation, and Geometry and measurement. However, as Table 16 shows, the level of support dropped considerably in other areas of mathematics. For example, less than one-half of the teachers reported that their textbooks provided good support for their efforts to make connections between mathematics and other subjects.[19]

Fifth-grade textbooks were somewhat better aligned with most aspects of the curriculum than eighth-grade textbooks, according to the teachers. The one exception was in the area of Algebraic ideas. Only one-third of the fifth-grade teachers said their textbooks supported teaching algebraic ideas well compared to three-quarters of the eighth-grade teachers

Table 16

Textbook Support for Mathematics Content (Percent of Teachers Whose Textbook Supported Content Area "Moderately Well" or "Very Well")

Content Area	Fifth Grade	Eighth Grade
Number and computation	90	78
Geometry and measurement	80	65
Statistics and probability	55	52
Algebraic ideas	34	77
Connections between mathematics & other subjects	48	30
Mathematical communication	65	38

Fifth-grade teachers from high-gain schools thought better of their textbooks than fifth-grade teachers from low-gain schools. For example, 50 percent of fifth-grade teachers from high-gain schools said their textbooks supported "algebraic ideas" moderately or very well, compared to only 22 percent of teachers from low-gain schools. Sixty-nine percent of fifth-grade teachers from high-gain schools said their textbooks supported "mathematical communication" well, compared to only 41 percent of teachers from low-gain schools. Unfortunately, we cannot associate these rating with specific textbooks.

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[19] These results are somewhat difficult to interpret since we do not know which textbooks different teachers are using.

School Support

Teachers provided a generally positive picture regarding the support they are given by their schools and districts. For example, three-quarters of the teachers reported that all or most of the materials they need to teach mathematics are available at their school. Table 17 summarizes teachers' responses to questions about school and district support. Almost all teachers (93 percent) agreed that their school administration actively supports teacher's efforts to improve mathematics instruction. They also confirmed teachers in their school frequently share ideas and materials to improve mathematics teaching. However, such sharing must take place outside of class because few teachers regularly observe each other's lessons. Time seemed to be a limiting factor on instructional improvement. Few teachers thought there was adequate time to meet together or to plan new lessons. This may explain the earlier

Table 17

School Support for Change (Percent of Teachers Who Agreed "Somewhat" or "Strongly" with Statement)

Statement	Fifth Grade	Eighth Grade
The school administration actively supports teachers' efforts to improve mathematics instruction	93	92
Teachers in this school frequently share ideas and materials to improve mathematics teaching	78	80
My school or district provides many opportunities for teachers to learn new mathematics concepts and practices	45	53
Teacher have enough opportunities to meet together to work on mathematics lessons	25	17
Teachers have enough time to plan new lessons and prepare new materials in mathematics*	24	18
Teachers in this school regularly observe each other teaching classes as part of sharing and improving instructional strategies	13	22

* Reversed

finding that other teachers did not greatly influence what was taught or how it was taught (see p. 40). These results did not vary greatly across grade level or for teachers in high-gain and low-gain schools.

The availability of remedial and enrichment opportunities in mathematics has changed during the past three years, but there is no consistent pattern to this change. About one-third of the fifth-grade teachers reported an increase in the availability of remedial services and about one-third reported a decrease. The bulk of the teachers reported that the availability of enrichment services in mathematics had not changed during the past three years, although the increases out numbered the decreases 36 percent to 18 percent. In eighth grade, the balance was tipped toward increased availability of both remedial and enrichment services.

In high-gain schools twice as many teachers reported increases in remedial and enrichment services as in low-gain schools. For remedial services, 46 percent of teachers in high-gain schools reported an increase compared to 21 percent of teachers in low-gain schools. The comparable figures for enrichment services were 49 percent compared to 21 percent.

At least partially as a result of these support systems, most teachers thought their schools' mathematics programs served the needs of all students moderately well. Overall, more than one-half of teachers rated their school's mathematics program either as outstanding (9 percent) or good (48 percent) in this regard, and all but 6 percent said it was at least adequate.

Assessment and Grading Practices

The majority of teachers reported that they have increased the amount of time they spend assessing students' mathematics skills—67 percent of teachers who have taught at least three years reported an increase in teacher-initiated classroom assessment. Teachers assigned individual, short-answer open-response tasks most frequently. Slightly more than one-half of the teachers gave such tasks at least once a week, and about one-third of the teachers assigned them one or two times a month. Individual, open-response tasks requiring a longer answer or a table, chart or figure were assigned almost as often. Group tasks were the next most frequent type of assessment, and multiple-choice questions were used least often. Thirty-nine percent of fifth-grade teachers and 51 percent of eighth-grade mathematics teachers *never* assigned multiple choice questions. Over seventy-percent of both groups assigned them at most once a semester.

Table 18 shows the frequency with which teachers use various types of problems to assess students' mathematics skills and the change in frequency during the past three years. As was the case for other teaching practices, traditional approaches dominated, but the greatest changes was an increase in standards-based approaches. Teachers in both grade five and grade eight reported using problems like those learned in class far more frequently than difficult, novel, or extended problems. However, they also reported that their use of the more difficult, novel, and extended problems had increased the most during the past three years.

Table 18

Use of Types of Mathematical Problems (Percent of Teachers Who Use Problem Type "Frequently" and Percent Who Increased Use During the Past Three Years)

	Fifth Grade		Eighth Grade	
Problem type	Frequent Use	3-year Increase	Frequent Use	3-year Increase
Traditional approaches				
Computations similar to those learned in class	82	11	77	7
Word problems similar to those learned in class	80	31	64	26
Standards-based approaches				
Problems that are more difficult than those learned in class	30	45	20	30
Novel, non-routine problems	20	65	19	38
Extended investigations	21	57	15	50

For the most part teachers in fifth and eighth grade responded similarly. The one exception to this pattern was the use of novel, non-routine problems. More fifth-grade teachers reported they had increased their use of these problems in assessment than eighth-grade teachers (65 percent vs. 38 percent).

Similarly, teachers in high-gain and low-gain schools responded similarly to questions about assessment. There were four interesting exceptions to this pattern. Fifth-grade teachers in schools that had the smallest gains on the KIRIS mathematics assessment during the second biennium were more likely to say that they have increased the amount of time they spend on mathematics assessment than teachers in schools that showed the largest gains (70 percent compared to 48 percent). In eighth grade, mathematics teachers in high-gain schools were more likely to report assessing students "frequently" using "problems that are more difficult than those learned in class" than mathematics teachers in low-gain schools (40 percent compared to 10 percent). Multiple-choice tests were used infrequently in both grade levels, but teachers in high-gain schools were more likely to report that they never use multiple-choice questions to assess students in mathematics than teachers in low-gain schools (59 percent compared to 40 percent). Also in both grades more teachers in high-gain schools than low-gain schools increased their use of extended investigations to assess students in mathematics (62 percent compared to 41 percent).

Teachers used a large number of factors in assigning course grades. The vast majority of the teachers gave the following factors: "a moderate amount" or "a great deal" of weight in grading: open-response exercises (95 percent); short quizzes or tests (94 percent); portfolio entries (85 percent); homework results (83 percent); culminating projects (82 percent); homework timeliness (77 percent); performance tasks (74 percent); and participation in discussions (72 percent). It is interesting to note the factors that teachers counted "little or none" in grading: mid-year or final exams (73 percent); interest in and attitude toward mathematics (54 percent); and textbook chapter tests (41 percent).

Many teachers have changed their grading practices over the past three years. The majority of teachers reported they had increased the amount they counted open-response exercises and portfolio entries in assigning grades (72 percent and 57 percent respectively). The only factor whose importance declined for an appreciable number of teachers (23 percent) was textbook chapter tests.

For the most part, there was little difference in grading practices between fifth and eighth-grade teachers. The only exceptions were the weight given to participation in discussion and interest and attitudes toward mathematics by the two groups of teachers. A higher percentage of fifth-grade teachers than eighth-grade teachers gave "a moderate amount" or "a great deal" of weight in course grades to participation in discussions (86 percent compared to 58 percent) and interest in and attitude toward mathematics (65 percent compare to 28 percent).

There were a few interesting differences in grading practices between teachers in high-gain and low-gain schools. In both grades, more teachers in high-gain than low-gain schools increased the amount they counted performance tasks in grading (43 percent vs. 20 percent). In addition, in fifth grade, more teachers from high-gain schools than low-gain schools (42 percent compared to 18 percent) counted mid-year or final exams "a moderate amount" or "a great deal" in mathematics grading. Fewer teachers in high-gain schools than low-gain schools counted participation in discussion (93 percent compared to 70 percent) substantially in grading, but more teachers from high-gain than low-gain schools decreased the amount they counted mid-year or final exams (36 percent compared to 17 percent) and homework results (19 percent compared to 0 percent) in assigning grades.

Portfolios

Although mathematics portfolios were officially "on hiatus" during 1996-97 and did not contribute to KIRIS scores, there appeared to be strong momentum on the part of districts and teachers to continue their use in both fifth and eighth grades. Three-quarters of the teachers continued to have students compile mathematics portfolios on either a formal or an informal basis. About one-half of these teachers reported they were required to do so by their school or district; the other half did it voluntarily. Furthermore, 44 percent of the fifth-grade teachers and 56 percent of the eighth-grade mathematics teachers said they intended to score the portfolios this year, although only about two-fifths of these teachers intended to score them formally using the old Kentucky rubric or a modified version of it.

On the other hand, teachers had more negative than positive opinions regarding the use of portfolios in their classes.[20] Such results were not surprising. Weaknesses reported by classroom teachers contributed to the decision to place the mathematics portfolios on hiatus for two years while they were re-designed. Over 90 percent of the teachers agreed or strongly agreed that "the heavy emphasis on writing in the portfolios has caused students to become tired of writing." This may explain, in part, why over 80 percent disagreed with the statement that "my students enjoy doing portfolio tasks more than other mathematics assignments." Over 90 percent of the teachers agreed that "portfolios make it difficult to cover the regular mathematics curriculum."

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[20] It seems fair to assume that the decision to redesign the mathematics portfolio system sent a negative signal about the existing process.

Teachers' opinions were mixed regarding the importance of the mathematical skills emphasized by the portfolios. Over 80 percent agreed that portfolios "place too much emphasis on process skills (e.g., writing, mathematical communication) rather than content (e.g., operations, fractions)." But a similar percentage agreed that the mathematics portfolios "reflect aspects of mathematics that I believe are important." Unfortunately, the survey did not provide an opportunity for teachers to explain which aspects of mathematics were important.

Portfolios had positive effects on instructional innovation, but they continued to be perceived as a burden by many teachers. Roughly two-thirds of the teachers in both grades agreed that portfolios "led me to be more innovative in planning mathematics lessons and activities." Yet, teachers were evenly divided about the demands of the portfolios. One-half of the teachers agreed and one-half disagreed that it "had become easier to find good portfolio tasks" and that "portfolios were less of a burden each year."

Teachers were least enthusiastic about the use of portfolios for accountability. Two-thirds questioned the use of portfolio scores to judge students' overall mathematics achievement. They were more positive about the use of portfolios for classroom assessment. One-half of the teachers indicated that they use portfolio scores to help judge how effective their own teaching has been.

Finally, it appears that teachers are developing a common understanding of the desired features of portfolio prompts. There was almost universal agreement that good tasks should be "interesting and engaging," "related to the students' real world," and "closely tied to [the] current mathematics lesson." There was some disagreement regarding the amount of structure that should be present in a good portfolio prompt. Three-quarters or more of the teachers in both grade levels agreed that tasks should be "open ended," but there was variation in how they interpreted this. Seventy-three percent of fifth-grade teachers thought portfolio prompts should have more than one correct solution, which seems consistent with being open-ended. However, 56 percent thought prompts should include step-by-step directions for students, which some would consider to be inconsistent with being open-ended. Fewer eighth-grade mathematics teachers agreed that good tasks should have multiple solutions (58 percent) or step-by-step directions (38 percent).

In fifth grade, there were some differences in portfolio practices between teachers in high-gain and low-gain schools. Seventy-four percent of the fifth-grade teachers in high-gain schools whose students were compiling portfolios were doing so because their school or district required them to. In low-gain schools, only 37 percent of those who were compiling portfolios were required to do so. Although most fifth-grade teachers were critical of portfolios as measures of student achievement, the criticism were greater among teachers in low-gain schools. Sixty-eight percent of fifth-grade teachers in high-gain schools agreed that portfolios were a poor method of judging of students' overall mathematics achievement compared to 89 percent of fifth-grade teachers in low-gain schools.

Since the mathematics portfolios are currently being redesigned, these results may be most useful as a baseline for comparing teacher beliefs and behaviors before and after the new portfolio system is in place.

WRITING TEACHING AND LEARNING

Teacher Education and Experience

Fourth-grade teachers and seventh-grade writing teachers have strong educational backgrounds (albeit in a variety of subject areas), considerable teaching experience, and moderate lengths of service in their current schools.[21] The majority of the fourth- and seventh-grade teachers surveyed reported that they have a master's degree or higher. In fourth grade, 59 percent of the teachers have a Masters' degree and 21 percent have a Kentucky Rank One Certificate, which requires 30 hours of coursework beyond a Masters' degree. In seventh grade, 53 percent of the writing teachers have a Masters' degree and 22 percent have a Kentucky Rank One Certificate.

The median number of years of teaching experience for fourth-grade teachers was nine years and for seventh-grade writing teachers it was seven years. Most of this teaching was done in their current school. The median number of years of teaching experience in their current school was eight years for fourth-grade teachers and five years for seventh-grade writing teachers.

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[21] These results are similar to those for fifth-grade teachers and eighth-grade mathematics teachers.

The majority of the fourth-grade teachers (71 percent) were certified in Elementary education (as were the majority of fifth-grade teachers). However, only 22 percent of fourth-grade teachers specialized in writing, English, or language arts in either their credential preparation program or when they renewed their teaching credentials. In contrast, seventh-grade writing teachers were more diverse in terms of certification and were far more likely to specialize in writing, English, or language arts. Their teaching certificates were divided roughly equally among Elementary education (39 percent), Middle School (46 percent), and Secondary Grades (32 percent).[22] The majority of the seventh-grade writing teachers (58 percent) specialized in writing, English, or language arts in their teacher preparation program, and almost one-third (30 percent) specialized in writing, English, or language arts when they had their credentials renewed. Overall, about two-thirds of the seventh-grade writing teachers specialized in writing, English, or language arts during preservice training or credential renewal.

There was no difference in teaching experience or subject matter preparation between teachers in high-gain and low-gain schools in either grade level.

School and Classroom Organization

Classroom organization for fourth-grade instruction was more varied than we anticipated. About half (48 percent) of Kentucky fourth-grade teachers described their school's instructional organization as consisting of self-contained classrooms but an equal number (47 percent) described it as "semi-departmentalized," with students receiving instruction in academic subjects from more than one teacher.[23] By the time students reach the seventh grade, they are typically assigned to a different teacher for each subject. In 82 percent of schools, seventh-grade instruction was completely departmentalized, while 15 percent of schools had a semi-departmentalized seventh grade. We found no relationships between school and classroom organization and KIRIS gains in fourth or seventh grade.

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[22] Teachers can hold teaching certificates in more than one category.

[23] See chapter on mathematics for a discussion of what semi-departmentalized classrooms might look like.

The majority of teachers reported that their schools did not group students by ability when assigning them to classrooms. However, ability grouping was more common at the seventh-grade level than at the fourth-grade level. Thirteen percent of seventh-grade teachers work in schools where students were assigned to classes by ability, compared to only four percent of fourth-grade teachers. Ability grouping at the school level was not associated with differences in KIRIS gain scores in writing at either grade level.

Ability grouping can also occur within classes, but the majority of teachers at both grade levels reported that they seldom used ability grouping for writing instruction. Almost 60 percent of teachers indicated that they "rarely" group students by ability for writing instruction and another 18 percent only use such grouping occasionally.[24] There was not much difference between teachers in high-gain and low-gain schools in the use of ability grouping for writing instruction.

One of the reasons teachers may not use ability grouping for writing instruction is that students work individually during a large part of their writing lessons. On average, teachers reported that 42 percent of the instructional time in writing is spent with students working on their own, another 27 percent of the time is spent with students working in small (2-4 students) or large (5 or more students) groups. For the remaining one-third of the instructional time, teachers reported that they taught writing to the whole class. This pattern was similar for teachers in low-gain and high-gain schools.

Professional Development and Preparedness

Almost all fourth- and seventh-grade teachers participated regularly in professional development. Teachers reported that they benefited from the training they received, and expressed confidence in their ability to teach writing. There was little or no difference in professional development or preparedness between teachers in high-gain and low-gain schools at either grade level.

All of the teachers surveyed participated in formal professional development activities in the current school year and almost all participated in each of the past two years as well (95 percent and 93 percent for 1995-96 and 1994-95, respectively). In fourth grade, the professional development experiences covered a wide range of topics, but Language Arts was very popular. Three-quarters of the teachers (79 percent) reported that much of their professional development ("a moderate amount" or "a great deal") focused on Language Arts curriculum and instruction. A majority of the teachers reported that much of their professional development focused on mathematics curriculum and instruction (53 percent) or curriculum and instruction in other subjects (56 percent). In seventh grade, more than three-quarters of the seventh-grade writing teachers (78 percent) indicated that "a moderate amount" or "a great deal" of this professional development focused on Language Arts curriculum and instruction compared to only 21 percent for mathematics curriculum and instruction and 35 percent for curriculum and instruction in other subjects.

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[24] Similar results were reported for reading instruction; 54 percent of teachers rarely group students by ability for reading and 14 percent use such grouping occasionally.

KERA goals and academic expectations, preparation for the KIRIS assessments, and portfolio development and scoring were popular topics for professional development for teachers in both grade levels. Overall, more than 70 percent of the teachers participated in professional development that focused "a moderate amount" or "a great deal" on portfolios development (85 percent), portfolio scoring (84 percent), preparing students for the KIRIS assessments (73 percent), and KERA goals and academic expectations (72 percent). In contrast, fewer than one-half participated in professional development that focused strongly on classroom assessment methods (44 percent) or the use of educational technology (49 percent).

Specific training in teaching writing was also widespread. Ninety-five percent of fourth-grade teachers and seventh-grade writing teachers reported that they had received special training to teach writing at some point in their careers. This included undergraduate courses, graduate course, continuing education, training through the Kentucky Writing Program, and other (non-specified) professional development. More than one-half of the teachers (59 percent) had received training through the Kentucky Writing Program at some point in their careers. In addition, during the last three years, 27 percent of the fourth-grade teachers and 39 percent of the seventh-grade writing teachers acted as trainers providing professional development in writing for other teachers. A greater percentage of fourth-grade teachers from high-gain than low-gain schools received special training to teach writing from "other professional development" (92 percent compared to 72 percent). Otherwise there was no difference in writing training between teachers in high-gain and low-gain schools.

Teachers indicated that professional development had a positive effect on their ability to teach writing. The majority of teachers reported that professional development helped them "a moderate amount" or "a great deal" with every aspect of teaching writing that we asked about. Specifically, professional development helped teachers: improve students' writing portfolios (73 percent), teach prewriting skills (68 percent), integrate writing across the curriculum (66 percent), teach students how to draft a piece (64 percent), teach writing through the study of literature (60 percent), teach students how to revise their writing (60 percent), conference with students about their writing (59 percent), teach students how to edit their writing (57 percent), and teach students how to publish their writing (56 percent). There were no sizable differences between the responses of fourth-grade teachers and seventh-grade writing teachers.

The majority of teachers in both grades felt "fairly well prepared" or "very well prepared" to teach most aspects of writing, and there was very little difference between the responses of teachers at the two grade levels (see Table 19).

Table 19

Teacher Preparation for Writing Topics (Percent of Teachers Who Were "Fairly Well" or "Very Well" Prepared)

Topic	Fourth Grade	Seventh Grade
Mechanics (spelling, punctuation, and capitalization)	92	91
Sentence structure	88	89
Logical organization	87	86
Use of effective language	86	85
Idea development	85	77
Focused purpose	81	79
Writing in a variety of genres/forms	78	73
Awareness of audience	61	74
Tone/voice	56	67

At both grade levels, the two topics that the greatest number of teachers felt well prepared to teach were "mechanics" and "sentence structure." The three topics that the fewest number of teachers felt well prepared to teach were tone/voice, awareness of audience, and writing for a variety of genres. Thus, teachers feel most comfortable teaching traditional aspects of writing rather than the reform-based aspects of writing. There were no associations between KIRIS gains in writing and teacher preparedness.

Curriculum Emphasis

Allocation of Instructional Time Across Subjects[25]

Fourth-grade teachers who taught all subjects reported that instructional time had stayed the same or increased in almost all academic subjects.26 However, more teachers reported increased time in the subjects tested by KIRIS in their grade level than in other subjects. Table 20 shows the median hours per week devoted to each subject by fourth-grade teachers, and the percent of teachers

Table 20

Fourth-Grade Subject Coverage and Change in Coverage (Percent of Teachers Reporting Increase in Coverage During Past Three Years)

Subject	Median Hours per Week	Percent Increasing Coverage
Mathematics	5	34
Writing*	5	90
Arts and Humanities	2	44
Practical Living/ Vocational Studies	1	30
Science*	4	45
Social Studies	4	15
Reading*	5	36

* Denotes subject tested in KIRIS in grade four; other subjects are tested in grade five.

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[25] Thirty-two percent of fourth-grade teachers indicated that they did not teach all subjects and skipped the questions about the allocation of instructional time across subjects. They were excluded from the results reported in this section.

[26] Very few teachers reported decreasing the time they spent on any subject. This could occur if teachers increased the total amount of instructional time by reducing non-instructional activities, if they conducted more inter-disciplinary activities that were counted as time for both subjects, or if their estimates were inflated. In any case, there is no reason to question the relative changes in time among subjects.

who increased the time spent on each subject. Fourth-grade teachers reported spending the most time on reading, writing and mathematics. Furthermore, almost all of the fourth-grade teachers (90 percent) reported that they increased the amount of time they devoted to writing during the past three years.

The allocation of time across subject was similar for fourth-grade teachers in high-gain schools and low-gain schools. However, more fourth-grade teachers in high-gain schools than in low-gain schools reported increases in the time spent on reading (54 vs. 29 percent), science (48 vs. 28 percent), arts and humanities (56 vs. 32 percent), and practical living/vocational studies (39 vs. 11 percent).

One of the goals of KERA was to encourage teachers to integrate writing with other subjects. Integration occurred quite often in fourth grade.[27] Over three-quarters of the fourth-grade teachers integrated writing with another subject at least once a week. Integration was most frequent in social studies and science, where about two-thirds of the teachers (66 percent and 63 percent, respectively) reported integrating writing with each of the two subjects at least once a week. There were no consistent differences between fourth-grade teachers in high-gain and low-gain schools in the frequency of integrating writing with other subjects.

There were substantial increases in the amount of integration that occurred in fourth grade. Almost all fourth-grade teachers reported that they increased the amount that they integrated writing with at least one other subject over the past three years. The majority of teachers reported increasing the integration of writing with science (69 percent), social studies (59 percent), and mathematics (56 percent). A greater percentage of fourth-grade teachers in high-gain than low-gains schools increased the integration of writing with social studies (74 percent vs. 45 percent) and with practical living/vocational studies (44 percent vs. 25 percent).

Seventh-grade teachers were asked a slightly different question: how often they worked on student writing with teachers from other subjects. Such inter-teacher collaboration about writing does not occur that frequently. Only 24 percent of writing teachers reported working with the social studies teacher at least once a week and fewer than 15 percent of the writing teachers reported working with teachers in any of the other subjects we asked about that frequently. However, there has been some increase during the past three years in the frequency with which seventh-grade writing teachers work with teachers in other subjects. Fifty-one percent of seventh-grade writing teachers reported that they have increased the frequency with which they work with teachers in at least one other subjects on student writing over the past three years. Social studies and science were the subjects where the most teachers reporting increasing the frequency of integration with writing (50 percent and 45 percent, respectively). More seventh-grade writing teachers from high-gain schools than low-gain school integrated writing with social studies at least once a week (38 vs. 9 percent). In addition, more seventh-grade writing teachers from high-gain than low-gain schools increased the frequency with which they work with teachers from the subjects of mathematics(54 percent vs. 15 percent), science (70 percent vs. 48 percent), and arts and humanities (50 percent vs. 31 percent).

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[27] A variety of different activities may be reported under the heading "integration," ranging from the use of writing while teaching or assessing another subject to the teaching of writing in the context of another subject.

Allocation of Instructional Time within Writing

Teachers were asked about the frequency of coverage of nine different aspects of writing. Table 21 shows that over three-quarters of the teachers in both grade levels cover all but two of the areas at least once a week. The topics that were addressed at least weekly by the largest percent of teachers were mechanics,

Table 21

Frequency of Writing Coverage (Percent of Teachers Who Cover the Topic at Least Once a Week)

Topic	Fourth Grade	Seventh Grade
Mechanics	93	82
Use of Effective Language	87	82
Idea Development	86	80
Sentence Structure	84	74
Logical Organization	82	79
Focused Purpose	79	81
Awareness of Audience	73	80
Tone/Voice	65	66
Writing in a Variety of Genres	55	53

use of effective language, and idea development. The two aspects of writing that were addressed at least weekly by the fewest number of teachers at both grade levels were tone/voice and writing in a variety of genres.

Most teachers also reported increasing the frequency of coverage of most aspects of writing during the past three years. More than one-half of the teachers in both grades reporting increasing the time they devote to all aspects of writing except sentence structure and mechanics (see Table 22). More teachers reported increasing time spent on awareness of audience and focused purpose than on any of the other aspects of writing, which is consistent with the emphasis of the Kentucky reform of writing.

Table 22

Change in Writing Coverage (Percent of Teachers Who Increased Coverage During the Past Three Years)

Topic	Fourth Grade	Seventh Grade
Mechanics	38	45
Use of Effective Language	56	52
Idea Development	66	65
Sentence Structure	53	45
Logical Organization	59	64
Focused Purpose	71	72
Awareness of Audience	70	76
Tone/Voice	61	66
Writing in a Variety of Genres	58	56

There were no differences in the frequency of coverage between teachers in high-gain and low-gain schools. However, more teachers in high-gain schools than low-gain schools reported increasing their coverage of writing in a variety of genres/forms during the past three years (68 percent vs. 46 percent in fourth grade and 77 percent vs. 48 percent in seventh grade). In addition, more seventh-grade writing teachers in high-gain schools than low-gain schools reported increasing the frequency of coverage of use of effective language (74 percent vs. 54 percent), sentence structure (69 percent vs. 40 percent), logical organization (80 percent vs. 59 percent), tone/voice (78 percent vs. 59 percent), mechanics (62 percent vs. 40 percent) and idea development (78 percent vs. 59 percent).

Instructional Practices

We examined a number of aspects of writing instruction, including the teachers' overall philosophy and instructional approach, expectations for student performance, specific teaching strategies, and student learning activities.

Philosophy and Approach to Teaching Writing

Teachers characterized their overall approaches to teaching writing on four dimensions defined by contrasting statements. For three of the four dimensions, the statement at one end of the continuum was more consistent with a standards-based approach and the statement at the other end was more consistent with a traditional approach.[28] These three dimensions concerned goals for student writing, the order of presentation of the elements of writing, and the teachers' overall goals for instruction. Teachers indicated whether they emphasized the mechanics of writing vs. communicating clearly, taught spelling and grammar before purpose and audience vs. teaching purpose and audience before or simultaneously with spelling and grammar, and emphasized transmitting knowledge to students vs. encouraging thinking and questioning. Each dimension had five levels, including one that was midway between the two descriptors. Teachers marked one of five points that reflected their approach.

On the three dimensions that related to writing, two-thirds or more of the teachers rated themselves closer to the standards-based end of the continuum than to the traditional end. For example, 82 percent of fourth-grade teachers and 77 percent of seventh-grade writing teachers placed themselves closer to the goal "to help students communicate clearly through writing" than the goal "to help students learn the mechanics of writing." Similarly, 68 percent of fourth-grade teachers and 84 percent of seventh-grade writing teachers identified more closely with teaching purpose and audience before (or while) teaching spelling and grammar than with teaching spelling and grammar before purpose and audience. Over three-quarters of both groups identified their overall goals more closely with encouraging thinking and questioning than with transmitting knowledge. There were no significant differences in overall approach to teaching writing between teachers in high-gain and low-gain schools.

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[28] The fourth dimension concerned overall philosophy of instruction (in-depth study of a few topics vs. comprehensive coverage of many topics) which was not strongly associated with either approach to teaching writing. Teachers tended to place themselves in the middle on this dimension.

Responses to additional questions about teaching approach demonstrated some uncertainty on the part of teachers about the amount of structure that is needed to promote effective writing. Almost all teachers agreed that students require a good deal of practice to become competent writers and that different students learn to write in different ways. However, as in mathematics, there was less agreement about the degree to which students should be left to puzzle things out for themselves. Table 23 shows that at least a small majority of teachers agreed with three somewhat contradictory statements. On the one hand, most teachers believed students should be given step-by-step instructions and should have their errors correctly quickly. On the other hand, a small majority endorsed the notion that students should be allowed to figure things out for themselves, which would not be the case if the first prescriptions were strictly followed. There were strong similarities between the responses of fourth and seventh-grade teachers, and between teachers in high-gain and low-gain schools.

Table 23

Teachers' Opinions About Learning to Write (Percent of Teachers Who Agreed with Statement)

	Fourth Grade		Seventh Grade	
Statement	Somewhat Agree	Strongly Agree	Somewhat Agree	Strongly Agree
Students' errors should be corrected quickly so they do not become frustrated	45	13	61	13
Students should receive step by step directions to aid in producing a successful, final, written product	52	32	50	33
Students learn best if they have to figure things out for themselves instead of being told or shown what to do	38	13	41	10

Expectations for Student Performance

A key assumption of the Kentucky educational reform is that all students can learn to high levels, but teachers of writing find it difficult to endorse this belief in practice (see Table 24). Although almost two-thirds of fourth-grade teachers and one-half of seventh-grade writing teachers believe all student can become successful writers, less than one-half of fourth-grade teachers and one-quarter of seventh-grade writing teachers think all students can attain existing grade level expectations. In fact, a high percentage of teachers in both grade levels agreed that there are some students who will never perform above the level of Novice in writing. Consistent with these beliefs, only about one-half of the teachers thought the same standards should be used to evaluate the work of all students. In most cases, teachers in low-gain and high-gain schools held similar expectations. The one exception to this pattern was that a lower percentage of fourth-grade teachers in high-gain schools than low-gain schools thought all students could learn fourth-grade writing by the end of fourth grade (37 percent compared with 55 percent).

Teachers' responses suggest it may be difficult to set appropriately high expectations that motivate greater achievement without over-burdening students. Over 80 percent of teachers agreed that teachers in their school push students fairly hard in academic subjects, but over 80 percent also agreed that if you put too much pressure on students they can lose their enthusiasm for writing.

Table 24

Teachers' Expectations for Students' Writing (Percent of Teachers Who Agreed "Somewhat" or "Strongly" with Statement)

Statement	Fourth Grade	Seventh Grade
With appropriate practice and instruction, all students can become successful writers	65	48
There are some students who will never perform above the level of Novice, no matter how much effort the teacher devotes to them	67	81
I believe all students can learn fourth [seventh] grade writing by the end of fourth [seventh] grade	47	22
Teachers should use the same standards in evaluating the work of all students in class	53	58

Interestingly, teachers think it is more difficult to improve the performance of students who are writing well than students who are writing poorly. A greater percentage of teachers thought it would be more difficult to move students from Proficient to Distinguished in writing than from Apprentice to Proficient or from Novice to Apprentice. At both grade levels, almost one-half of the teachers thought it would be most difficult to take students who were Proficient writers and help them become Distinguished writers. About one-quarter thought it would be most difficult to move students from Apprentice to Proficient, and only 14 percent thought that moving Novice writers to Apprentice would be the most difficult.

Teaching Strategies

There has been considerable change in emphasis within writing at both grade levels. Fifty-one percent of all teachers reported that the content of their writing lessons had changed a major amount during the past three years.[29] An additional 30 percent indicated that the content had changed a moderate amount. These changes are reflected in teachers' overall approach to writing and the way they address specific aspects of writing instruction, including the purposes for which student write, the way written pieces are started, and the kinds of feedback teachers give to students. These topics will be discussed in the succeeding paragraphs.

The writing process approach to instruction was used frequently by more teachers than any other method. Ninety-three percent of teachers at both grade levels use writing process instruction frequently. This compared to 67 percent who frequently used integrated reading and writing, 46 percent who frequently used writing to learn, and 44 percent who frequently used mechanics or skills-based instruction. Fourth-grade teachers were more likely than seventh-grade writing teachers to use writing to learn (53 percent vs. 39 percent) and mechanics or skills-based approaches (54 percent vs. 34 percent) frequently. There was no difference in approach between fourth-grade teachers in high-gain and low-gain schools, although seventh-grade writing teachers in high-gain schools were much more likely to use skill-based instruction frequently than were seventh-grade writing teachers in low-gain schools (66 percent vs. 20 percent). While the writing process approach is the most common, many teachers regularly use multiple methods for teaching writing.

Teachers ask students to write for a number of different purposes, with fourth-grade teachers assigning writing for a greater variety of purposes than seventh-grade writing teachers (see Table 25). The largest percentage of teachers in both grade levels gave writing assignments in which students were asked to share facts or information or to write for a purpose of their own choosing. The least common purposes at the fourth-grade level were pieces designed to reflect on student's own growth and pieces written to persuade an audience. Least common at the seventh-grade level were pieces designed to tell a story and pieces written to persuade an audience. This is consistent with seventh-grade writing teachers' responses to a question about writing styles. They reported that, on average, 36 percent of students' writing is narrative, 25 percent is descriptive, 20 percent is expository and 19 percent is persuasive.

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[29] Eleven percent had not taught writing long enough to answer the question.

There were few differences in writing purpose between teachers from high-gain and low-gain schools. In fourth grade, more of the writing assignments from teachers in high-gain schools ask the student to "tell a story" at least once a week (46 compared to 21 percent). In seventh grade, teachers from high-gain schools appear to be somewhat more flexible about assignments. A greater number of teachers from high-gain schools than low-gain schools gave weekly assignments in which the students wrote for a purpose of his or her own choosing (48 percent vs. 30 percent).

Table 25

Purposes for Writing (Percent of Teachers Assigning Writing for Each Purpose Once or Twice a Semester or Less and Once a Week or More)

	Fourth Grade		Seventh Grade	
Purpose	Rarely	Weekly	Rarely	Weekly
Share facts or information	12	51	34	32
A purpose of the student's own choosing	17	46	31	35
Tell a story	16	37	55	10
Explain a process or concept	26	32	48	19
Analyze or evaluation a situation, person, place or thing	32	30	49	21
Reflect on student's own learning or growth	44	30	46	22
Describe a scene	26	28	43	23
Evoke a feeling or mood	28	28	35	28
Persuade an audience	33	20	56	11

Teachers used a variety of starting points for student writing on a regular basis, and their choices are consistent with the standards-based approach to writing. Table 26 shows the percentage of teachers who used various starting points at least once a week. The most common starting point for writing at both grade levels was an idea or experience chosen by the student, which was used on a weekly basis by 56 percent of the teachers. Moreover, almost one-half of the teachers increased the use of student selected writing topics over the past three years. Teachers also increased the use of model pieces of writing as a starting point for student writing. The least common starting point for writing at both grade levels was a "story starter," which was used on a weekly basis by 11 percent of the teachers across the two grade levels. In fact, the two strategies whose use was reduced during the past three years by a substantial percentage of teachers were story starters (17 percent) and topics assigned by teachers (23 percent). The most notable difference between the grade levels was the use of work done in another subject area. As one might expect, seventh-grade writing teachers drew upon work from another subject only infrequently, although one-third had increased the frequency of this practice during the past three years. There were no major differences in starting points for student writing between teachers in high-gain and low-gain schools.

Table 26

Starting Points for Student Writing (Percent of Teacher Who Used Strategy at Least Once a Week and Percent Who Increased Use During Past Three Years)

	Fourth Grade		Seventh Grade	
Starting Point	Weekly Use	3-year Increase	Weekly Use	3-year Increase
Traditional approaches				
A story starter	17	12	6	22
A topic assigned by the teacher	50	21	24	25
A book read by the student	23	31	18	30
Standards-based approaches				
An idea or experience chosen by the student	59	42	55	62
A model piece of writing	36	46	40	58
An experience shared by students in the class	37	31	28	35
Work done in another subject area	45	57	10	35

Fourth-grade students wrote more often than seventh-grade students, and short written pieces were far more common than long written pieces at both grade levels. Two-thirds of the fourth-grade teachers reported that their students wrote short pieces (one to two paragraphs in length) almost daily compared to 42 percent of seventh-grade writing teachers. (Of course, seventh-grade students may be producing written work in other classes, which is not included in these reports.) Two-thirds of the fourth-grade teachers and slightly less than one-half of the seventh-grade writing teachers reported that students produced middle-length pieces (one to two pages) on a weekly basis. About one-half of the teachers in both grade levels reported that students produced long pieces (three or more pages in length) on a monthly basis. However, one-third of the teachers at both grade levels, said that students produced long written pieces only once or twice each semester. There were no differences in the reported frequency of short and middle-length student writing between teachers in high-gain schools and low-gain schools. However, a greater number of teachers in high-gain schools than low-gain schools reported at least monthly production of written pieces at least three pages in length (67 percent vs. 51 percent among fourth-grade teachers; 68 percent vs. 53 percent among seventh-grade writing teachers).

Teachers have many opportunities to give students feedback on their writing during the year. This feedback can take the form of written or oral comments about various aspects of the piece. More than one-half of the teachers reported that they almost always commented on the following aspects of students' writing: the strengths of the piece, how the student could improve the piece, focused purpose, idea development, logical organization, and mechanics. Between 40 percent and 50 percent of the teachers said they almost always commented on awareness of audience, sentence structure, and use of effective language. The vast majority of the teachers (70 percent to 90 percent) reported that they commented on these nine factors in more than half of the written pieces they reviewed. The two features that were least often reflected in teachers' feedback were tone/voice and sensitivity to genre/form. Between 21 percent and 25 percent of the teachers mentioned these aspects of writing on almost all the pieces of written work they reviewed. There was no difference in feedback on written work between teachers in fourth and seventh grade, or of between teachers in high-gain and low-gain schools.

At both grade levels, teachers were asked to imagine that they had just finished a lesson on persuasive writing and were having a conference with a student who had turned in a written draft. Figures 1 and 2 show the passages provided to teachers in fourth and seventh grade, respectively.

> Dear Mom and Dad,
> I think you should take me to the olympics because I would have fun. It would not cost lots of money. We could stay in a hotel and eat in restrants. I would like to see the kayaking. Dad said he would take me kayaking when I get older. I would learn alot watching the lympic kayakers.
> your son, Josh

Figure 1. Sample Fourth-Grade Writing Passage

> Yesterday I was woken up around five-thirty in the morning by sound of a motor running outside my window. I looked out my window and saw that it was the neighbor removing the snow in his drive using a snow blower. I laid back down and tried to return to sleep but could not. I began to ponder the question: Does this man have the right to run a snow blower this early in the morning?
> I think that there should be a city law outlawing the use of snowblowers between 10 pm and 6 am because they are noisy and cause people to lose sleep. Also, they are not necessary since it is possible to remove the snow without making such a ruckus. I realize that some people have long driveways and this is difficult but that was there choice and others should not have to lose sleep over it.
> In conclusion, since some people do not seem willing to be neighborly, I think city action is required to solve this problem.

Figure 2. Sample Seventh-Grade Writing Passage

Although the passages differed, teachers in both grade levels were asked about the same set of dimensions. There was consensus among the teachers about which features would be important to emphasize in a student conference. In fact, more than half the teachers said they would emphasize each of the features (see Table 27). Almost all of the teachers said they would place a moderate or great deal of emphasis on persuasiveness (99 percent), evidence to support claims, and idea development (both 97 percent). One difference between the grades was in regard to sentence structure—more fourth-grade teachers would emphasize sentence structure than would seventh-grade teachers (82 percent compared to 61 percent). Teachers from low- and high-gain schools only differed on one dimension: more fourth-grade teachers from high-gain schools would place a moderate or great deal of emphasis on "use of language" (81 percent vs. 62 percent).

Table 27

Teacher Feedback on Student Writing (Percent of Teachers Placing a Moderate Amount or a Great Deal of Emphasis on Each Element)

Element	Fourth Grade	Seventh Grade
Evidence to support claims	98	96
Mechanical errors	61	57
Idea development	95	99
Persuasiveness	99	97
Sentence structure	82	61
Voice	76	80
Organization	90	84
Use of language	71	63
Awareness of audience	82	90

Student Learning Activities

We also asked teachers about the types of activities students engage in when learning to write. Teachers ask students to do a variety of activities during writing instruction, including activities that emphasize the mechanics of writing, activities that emphasize the process of writing, and activities that emphasize the KIRIS scoring guides (see Table 28). Teachers have increased the frequency with which students do all the activities, with the greatest increases in the frequency of conferences and discussions of the writing portfolio scoring guides. A greater percentage of fourth-grade teachers than seventh-grade teachers reported weekly practice on mechanics, weekly conferences with individual students, and weekly critiques of writing with the whole class. A greater percentage of seventh-grade writing teachers in high-gain schools than low-gain schools reported weekly student practice on the mechanics of written English (92 percent vs. 61 percent). Similarly, greater percentages of seventh-grade writing teachers in high-gain schools than low-gain schools reported increases in the frequency of individual student conferences about writing (84 percent vs. 68 percent), critiquing writing with the whole class (76 percent vs. 57 percent), reading and discussing a professional authors work (58 percent vs. 35 percent), and learning about genres/ forms (55 percent vs. 33 percent). In fourth grade, teachers in high-gain schools were more likely than teachers in low-gain schools to report increases in individual conferences about writing (73 percent vs. 53 percent) and learning about genres/forms (55 percent vs. 30 percent).

Students spend considerable time working on various aspects of their written work. In a typical two-week period teachers at both grade levels reported that students spend an average of about four hours on drafting; an average three hours each on conferencing, prewriting, revising, editing, and publishing; and about two hours on studying examples of effective writing.

Table 28

Student Writing Activities (Percent of Teachers Reporting Activity Occurs at Least Once a Week and Percent Who Increased the Frequency During the Past Three Years)

Activity	Fourth Grade		Seventh Grade	
	Weekly Use	3-year Increase	Weekly Use	3-year Increase
Students practice the mechanics of written English	85	31	63	40
Conferences with individual students about their writing	88	63	60	77
Class discussion of the Kentucky writing portfolio scoring guide	49	58	39	67
Students learn about a variety of genres/forms	40	44	32	48
Critique a piece of student writing with the whole class	40	49	19	63
Students use the Kentucky scoring guide to assess their own or other students' writing	34	50	36	63
Students read and discuss a professional author's writing	29	32	27	46

Although all pieces of writing may not be addressed in the same way, a substantial proportion of teachers said that students engaged in multiple activities on almost all of the pieces they wrote. Table 29 shows the percentage of teachers reporting that students engaged in each writing activity on almost all the pieces they wrote. Revision and editing are the most prevalent activities. Students are less likely to gather information or conduct research prior to writing. Peer conferencing is more prevalent in seventh grade than in fourth grade. Although students do not publish every piece they write, 76 percent of the teachers reported that students publish more than half the pieces they write.

There were no differences in student activities among fourth-grade teachers in high-gain and low-gain schools. However, in seventh grade a greater percentage of writing teachers in high-gain than low-gain schools reported that students almost always engage in making notes or an outline (55 percent vs. 36 percent) and revising the piece at least once (82 percent vs. 63 percent).

Table 29

Activities of Student Writing (Percent of Teachers Indicating Students Engaged in the Activity for "Almost All" Written Pieces)

Activity	Fourth Grade	Seventh Grade
Gather information/conduct research before they write	2	6
Make notes or an outline before they write	34	52
Define the purpose and audience	43	58
Use conferencing with peers to improve their writing	41	63
Use conferencing with the teacher to improve their writing	56	49
Revise the piece at least once	70	68
Edit the piece to correct errors in mechanics	70	68
Publish the piece for others to read	38	36

Influences on Practice and Support for Change

KIRIS

The majority of teachers reported that the KIRIS writing portfolios have had a positive impact on writing instruction: 84 percent of fourth-grade teachers and 71 percent of seventh-grade writing teachers reported that the writing portfolios had either a small or large positive impact. Surprisingly, seventh-grade writing teachers in low-gain schools were more positive about the impact of the writing portfolios than their colleagues at high-gain schools (89 percent vs. 62 percent). This difference did not occur among fourth-grade teachers in high-gain and low-gain schools.

Although most fourth-grade teachers and seventh-grade writing teachers reported that KIRIS writing portfolios have had a positive impact on writing instruction, they attributed score improvements on KIRIS more to other factors (see Table 30). Differences between groups of students was the factor cited the by largest percentage of teachers in both grades as contributing "a great deal" to score gains. The next most often cited factor was increased student familiarity with the KIRIS portfolio assessment. On the positive side, two-thirds of the teachers in both grade levels reported that improvements in students' writing skills made at least a "moderate" contribution to score gains.[30]

Table 30

Reasons for KIRIS Score Gains in Writing (Percent of Teachers Who Reported that Each Factor Contributed "A Great Deal" to KIRIS Score Gains in their School)

Factor	Grade 4	Grade 7
Increased student motivation	16	2
Differences between groups of students from one biennium to the next	33	46
Broad improvements in students' writing skills	13	8
Specific improvements in the writing skills assessed by KIRIS	12	15
Increased student familiarity with the KIRIS portfolio assessment	32	22

State and Local Support for Reform

Writing teachers have had access to a wealth of information and support to enhance writing instruction. KDE and other sources have developed curriculum materials, provided training relating to portfolio development and scoring, and offered a wide range of professional development opportunities. We asked about the influence of five broad types of resources: curriculum guides and textbooks, assessments, local school and district staff, formal professional development, and personal experience and beliefs.[31]

The most influential item on the list was the KIRIS writing portfolios. Over 90 percent of the teachers indicated that the writing portfolios had a great deal of influence on what they taught in writing. There were six other resources that had a great deal of influence on the content of writing instruction for a majority of the teachers. Three of the influential resources were curriculum materials—the Kentucky Writing Portfolio Teacher Handbook (65 percent), *Core Content for Writing Assessment* (KDE, undated) (72 percent), and *Transformations* (KDE, 1995a) (56 percent). Two of the most influential resources were professional development activities—portfolio scoring training (57 percent) and portfolio development training (54 percent). The last item that strongly influenced writing instruction for a majority of teachers was personal experience and beliefs (62 percent).

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[30] Sixty-nine percent of fourth-grade teachers and 67 percent of seventh-grade writing teachers said "broad improvement in students' writing skills" contributed at least a moderate amount to writing score gains. Fifty-one percent (fourth grade) and 57 percent (seventh grade) said "specific improvements in the writing skills assessed by KIRIS" contributed at least a moderate amount to writing score gains. One KDE staff person indicated that there are no differences between broad writing skills and the skills being assessed in KIRIS, which may have confused teachers.

[31] We asked separately about the influence of these items on what writing teachers teach and how they teach writing. In general, teachers responded similarly to these two sets of questions, so we have chosen to present only the results for factors that influence what they teach.

Six other items exerted some influence for the vast majority of teachers. These were district curriculum guides, supplemental writing materials, cluster leaders, other teachers, the Kentucky Writing Program, and "other" professional development. The least influential factors were district curriculum specialists, principal or assistant principal, textbooks, commercial standardized tests, district or school tests, and university writing courses.

There were only minor differences between fourth-grade teachers and seventh-grade writing teachers or between teachers in high-gain schools and low-gain school in the reported influence of these factors. The most notable grade-related difference concerned how influential teachers found the portfolio scoring training: 68 percent of the fourth-grade teachers reported that it had a great deal of influence on what they taught whereas only 45 percent of seventh-grade teachers responded that way. The only sizable differences between teachers in high-gain schools and low-gain schools concerned the Kentucky Writing Program and portfolio development training, and the differences were in opposite directions. Teacher in low-gain schools were more likely than teachers in high-gain schools to report that the Kentucky Writing Program had a great deal of influence on what they taught in writing (52 percent and 34 percent in fourth grade, respectively; 40 percent and 24 percent in seventh grade, respectively). Conversely, teachers in high-gain schools were more likely than teachers in low-gain schools to report that portfolio development training had a great deal of influence on what they taught in writing (54 percent vs. 37 percent in fourth grade, and 56 percent vs. 43 percent in seventh grade).

Textbooks

Although the majority of teachers use a language arts or writing textbook (70 percent), they do not rely on it for writing assignments. Seventy-three percent of teachers who use a language arts or writing textbook reported that fewer than 25 percent of their writing assignments come from the textbook. Teachers rely more heavily on supplemental books and materials. Sixty-one percent of the teachers used supplemental materials at least once a week and about a quarter (26 percent) use them almost daily. Teachers in fourth and seventh grade reported similar textbook use as did teachers in high-gain and low-gain schools.

School Support

Teachers in both grade levels provided a generally positive picture regarding the support they are given by their schools and districts. For example, about three-quarters (74 percent) of the teachers reported that all or most of the materials they need to teach writing effectively are available at their school. Table 31 summarizes teachers' responses to questions about school and district support.

Table 31

School Support for Change (Percent of Teachers Who Agreed "Somewhat" or "Strongly" with Statement)

Statement	Fourth Grade	Seventh Grade
The school administration actively supports teachers' efforts to improve writing instruction	89	90
Teachers in this school frequently share ideas and materials to improve the teaching of writing	83	86
My school or district provides adequate opportunities to learn new writing concepts and practices	64	70
Teachers have enough time to plan new lessons and prepare new materials for writing*	24	28
Teacher have enough opportunities to meet together to work on writing lessons	25	25
Teachers in this school regularly observe each other teaching classes as part of sharing and improving instructional strategies	22	26

* Reversed

Most teachers agreed that their school administration actively supports teacher's efforts to improve writing instruction. They also confirmed that teachers in their school frequently share ideas and materials to improve the teaching of writing. However, time seemed to be a limiting factor on instructional improvement. Few teachers thought there was adequate time to plan new lessons and prepare new materials. Also, few teachers reported that they have enough time to meet with other teachers to work on writing lessons or to observe each other's lessons. These results did not vary greatly across grade levels or for teachers in high-gain and low-gain schools.

In many schools, the availability of remedial and enrichment opportunities in writing has changed during the past three years, but there is no consistent pattern to this change. In fourth grade, more teachers reported an increase in the availability of remedial services in writing than reported a decrease (42 percent and 19 percent, respectively). The same was true for enrichment services (45 percent and 12 percent, respectively). In seventh grade, teachers were more evenly divided in reporting increases and decreases in both remedial services (31 percent and 29 percent, respectively) and enrichment services (35 percent and 19 percent, respectively). Surprisingly there were no differences regarding remedial and enrichment support between teachers in high-gain and low-gain schools.

Overall, most teachers thought their schools' writing program served the needs of all students at least moderately well. More than half of teachers rated their school's writing program either as outstanding (14 percent) or good (41 percent) in this regard, and all but 13 percent said it was at least adequate. In fourth grade, more teachers in high-gain schools than low-gain schools rated their school's writing program as at least good (61 percent vs. 39 percent). There were no such differences in the seventh-grade results.

Assessment and Grading Practices

Teachers consider a number of different aspects of writing when assigning grades to student written pieces. Teachers in grades four and seven ranked the factors in roughly the same order in terms of importance in grading, but the percent of seventh-grade teachers for whom a particular aspect of a piece was "very important" in assigning a grade was higher than the percent of fourth-grade teachers responding to the same aspect.

The four factors that most fourth-grade teachers indicated to be very important in grading were idea development (80 percent), accomplishing the focused purpose of the task (78 percent), logical organization (71 percent), and the quality and creativity of the ideas (73 percent). About one-half of the fourth-grade teachers also said awareness of audience (56 percent) and appropriate tone and voice (44 percent) were very important. Far fewer fourth-grade teachers reported that the following were "very important:" length (8 percent), mechanics (25 percent), appropriate sentence structure (33 percent), and use of effective language (38 percent).

Most seventh-grade writing teachers indicated that idea development (91 percent), logical organization (89 percent), accomplishing the focused purpose of the task (87 percent), and the quality and creativity of the ideas (71 percent) were all very important in assigning grades to written work. In addition, most seventh-grade teachers marked awareness of audience (71 percent) as very important. Fewer teachers, but still a majority, marked that appropriate tone and voice (59 percent) and use of effective language (57 percent) were very important in grading. The factors judged to be important by the fewest seventh-grade teachers were length (7 percent), mechanics (29 percent), and appropriate sentence structure (40 percent).

For the most part, there was little difference in grading practices between teachers in high-gain and low-gain schools. The two exceptions were the importance given to use of effective language and appropriate tone and voice. In seventh grade, more teachers in high-gain than low-gain schools reported that use of effective language was very important in assigning grades (61 percent vs. 39 percent respectively). Also, more teachers in high-gain than low-gain schools reported that appropriate tone and voice was very important in assigning grades (69 percent vs. 50 percent respectively). The same trends were evident to a lesser extent in fourth grade.

Almost all of the teachers in both grades (87 percent in fourth grade and 88 percent in seventh grade) reported that their students receive a report card grade in language arts. About one-half said their students also receive a grade in writing. In fourth grade, over 90 percent of the teachers said their students receive a report card grade in reading, as well. In seventh grade, two-thirds of the teachers said there was a reading grade assigned to students. The language arts grade reflected reading, writing, speaking and listening, with the bulk of the emphasis divided evenly between reading and writing. In fourth grade, speaking and listening contribute only 5 percent each to the language arts grade; in seventh grade they contribute only 10 percent each to the language arts grade.

Portfolios

As noted above, the KIRIS writing portfolios have had a strong influence on writing instruction. This was reflected in teachers' opinions about the influence of portfolios and the demands they place on teachers. Two-thirds or more of the teachers agreed that students are writing more and better as a result of portfolios (80 percent), that portfolios have led them to be more innovative in planning writing lessons and activities (78 percent) and that portfolios have caused them to de-emphasize mechanics (69 percent). Teachers also agreed that portfolios have led them to allow students to make more decisions about their own writing (78 percent).

On the other hand, teachers report that portfolios are burdensome. About three-quarters of the teachers agreed that portfolios make it difficult to cover the regular curriculum (79 percent) and that the heavy emphasis on the writing portfolios has caused students to become tired of writing (73 percent). In addition, the burden does not seem to be decreasing for most teachers. Forty-nine percent of fourth-grade teachers and 73 percent of seventh-grade teachers disagreed with the statement "Portfolios are less of a burden this year than last." Scoring is a substantial part of the burden felt by teachers. Overall, 80 percent of teachers agreed that portfolio scoring is too time consuming. Although many teachers continue to see the portfolios as burdensome, they did report that it has become easier to find good ideas for portfolio tasks (80 percent).

There were very few differences in opinion between fourth-grade teachers and seventh-grade writing teachers. However, there were some differences between seventh-grade teachers in high-gain and low-gain schools. A greater percentage of seventh-grade writing teachers from low-gain schools than high-gain schools agreed that students are writing more and better as a result of writing portfolios (86 percent vs. 66 percent) and that writing portfolio scores are a good measure of [their] students' overall writing achievement (61 percent vs. 34 percent).

Because writing portfolio scores are the main measure of writing proficiency in KIRIS, it is important to examine the conditions under which students produce their portfolio pieces. There was considerable variation in teachers' reports of the origin of writing prompts and the amount of revision that was done to assessment portfolio pieces, but there was greater similarity in the level of feedback teachers gave to students and the process of choosing final portfolio entries.

Some teachers supplied almost all the prompts for student portfolio pieces while other teachers supply almost none of the prompts. About one-fifth of teachers (21 percent) reported that most student portfolio writing begins with a prompt supplied by the teacher. About half of teachers (52 percent) reported that student portfolio writing begins with a teacher-generated prompt one-quarter to one-half of the time. The remaining teachers, 27 percent, reported that student portfolio writing almost never begins with a prompt.

Most pieces in students' assessment portfolios were revised two or more times before they are completed. On average, about 20 percent of assessment portfolio entries were revised once, about 55 percent were revised two or three times, and about 35 percent were revised four or more times. However, there was considerable variation among teachers in these percentages. For example, in fourth grade the percent of pieces revised only once ranged from zero to 100 percent. In the typical fourth-grade classroom only 10 percent of the pieces were revised only once, but in about one-fifth of the classrooms 20 percent or more of the pieces were revised one time. These differences become clearer at the other end of the spectrum. In the typical fourth-grade classroom, only 10 percent of the pieces are revised four or more times. However, in about one-fifth of the fourth-grade classrooms, 50 percent or more of the pieces were revised four or more times. Similar variations in revision practices were reported by seventh-grade writing teachers.

There was comparable variation among teachers in the amount of time students worked on their portfolio pieces. On average, fourth-grade teachers reported that ten percent of assessment portfolio entries were completed (including revisions) in one to one and one-half hours, 18 percent were completed in one and one-half to two hours, and 68 percent were completed in more than two hours. Again, there were large differences among teachers. For example, in the typical fourth-grade classroom, students spent more than two hours each on 80 percent of their pieces, but in about one-fifth of the classrooms students spent more than two hours on only 25 percent of their pieces. The results were similar in the seventh grade. On average, seventh-grade teachers reported that three percent of assessment portfolio pieces were completed in less than one hour, eight percent were completed in one to two hours, 24 percent in two and one-half to four hours, 19 percent in four and a half to six hours, and 45 percent in more than six hours.[32] There were variations among teachers, as well.

In seventh grade, teachers in high-gain schools reported that their students spent more time completing assessment portfolio entries than teachers in low-gain schools. For example, the typical seventh-grade writing teacher in a high-gain school reported that 50 percent of assessment portfolio entries are worked on for more than six hours each compared to 20 percent of assessment portfolio entries in low-gain schools.

Almost all students receive frequent feedback from teachers as they work on their portfolio entries and they also receive feedback from other individuals. Nearly all teachers in both grades (98 percent) reported that their students frequently or always receive feedback from the teacher while drafting and revising assessment portfolio entries. Feedback from other sources varied by grade level. Most fourth-grade teachers reported that students frequently received feedback on their assessment portfolio entries from other students (65 percent) and from parents or other adults at school (41 percent). Few teachers (6 percent) reported that students received frequent feedback from parents or other adults outside of the school. In seventh grade, almost all teachers (87 percent) reported that students frequently received feedback on their assessment portfolio entries from other students. However, far fewer reported frequent feedback from parents or other adults, either at school (31 percent) or outside of the school (20 percent).

The large majority of teachers (87 percent) reported that assessment portfolio entries were selected from a broad collection of students' written work accumulated over the course of the year. Ninety-five percent of seventh-grade teachers and 73 percent of fourth-grade teachers allow students to choose writing pieces from previous years for revision and inclusion in their assessment portfolio. Fourth-grade teachers exercise more influence on the choice of pieces that go into students' assessment portfolios than seventh-grade writing teachers. On average, fourth-grade teachers reported that about one-third of the assessment portfolio entries are chosen by the student alone, about one-half are chosen by the student with input from the teacher, and the remainder are chosen by the teacher with some input from the students. In seventh grade, about one-half of the entries are chosen by the student alone, about 40 percent by the student with input from the teacher, and on only about 10 percent does the teacher have substantial influence.

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[32] The fourth-grade and seventh-grade surveys had different response options on this question, so the results cannot be compared directly.

Addressing the scoring criteria and demonstrating growth in performance are paramount concerns in choosing assessment portfolio pieces. Ninety-five percent of teachers indicated that it was either "somewhat important" or "very important" that pieces demonstrate achievement on all scoring criteria. Over ninety percent of teachers also said it was important that pieces show growth in performance. Two-thirds of the teachers also said the following criteria were important in selecting pieces for the assessment portfolios: neat and polished in appearance (82 percent), exemplary in one or two scoring dimensions (72 percent) and similar to best examples from scoring training (67 percent). More seventh-grade teachers in high-gain schools than in low-gain schools indicated that it was important for student's work to be exemplary in one or two scoring dimensions (80 percent vs. 62 percent).

Overall, about half the teachers believe that the writing portfolios are good measures of students writing. About half agreed (52 percent) and half disagreed (48 percent) with the statement "Writing portfolio scores are a good measure of my students' overall writing achievement."

SUMMARY AND CONCLUSIONS

Survey responses leave little doubt that KERA and KIRIS have had effects on mathematics and writing curriculum and instruction in Kentucky. Although Kentucky mathematics and writing teachers continue to cover much of the traditional content and employ traditional teaching methods, they are increasing their use of standards-based approaches in both subjects. These changes are consistent with the direction signaled by KIRIS, particularly the portfolios, and they are supported by state curriculum materials and professional development used by the teachers. The mathematics reform represents a greater break with past practices than the writing reform, and this can be seen in differences in the mathematics and writing surveys and teachers' responses to them. Within subjects, there are relatively few differences between elementary and middle schools, and those that exist primarily reflect differences in the organization of the schools, e.g., subject matter specialization. More importantly, despite the alignment between the standards, KIRIS assessments, state curriculum materials and training opportunities, there are few associations between KIRIS gains and reported classroom practices.

Teacher Preparation and Classroom Organization

Overall, Kentucky fourth- and fifth-grade teachers, seventh-grade writing teachers and eighth-grade mathematics teachers had high levels of formal professional training and moderate levels of teaching experience and tenure in their present positions. The majority of teachers at all four grade levels had a masters' degree or higher, and about one-quarter have Kentucky Rank One Certification, which requires 30 hours of coursework beyond a masters' degree. Most fourth- and fifth-grade teachers specialized in elementary education (rather than a specific subject) during their college training or their credential renewal process. In contrast, two-thirds of seventh-grade writing teachers and three-quarters of eighth-grade mathematics teachers specialized in their subject area during their initial training or credential renewal. However, this also means that one-third of seventh-grade writing teachers and one-quarter of eighth-grade mathematics teachers in Kentucky did not specialize in the subject we asked about at any point in their formal training.

In addition to their formal training, all Kentucky teachers in the grades and subjects we studied availed themselves of professional development opportunities on an annual basis. They chose professional development that focuses on KERA goals and outcomes, curriculum in their subject, and the KIRIS assessment in their subjects. Teachers rated professional development highly, particularly the support it provided for subject-matter instruction and the KIRIS assessments. Overall, teachers felt well prepared to teach most aspects of the subjects that we addressed. In fact, 20 percent to 30 percent of the teachers acted as trainers for other teachers.

We found it surprising that a substantial number of fourth- and fifth-grade teachers did not teach in "self-contained" classes but worked in "semi-departmentalized" schools, where students were taught their academic subjects by more than one teacher. Team teaching would be an example of such an arrangement. In contrast, instruction in most middle schools was fully departmentalized, with teachers responsible for a single subject.

Classroom Practices: Subject Matter Differences

The mathematics and writing teachers we surveyed provided similar responses to questions about classroom practices. Both groups mixed traditional and standards-based curriculum and instruction, with increasing attention to the standards-based practices. Both aligned themselves philosophically with standards-based approach. They agreed that the KIRIS assessments and the curriculum materials provided by the state were the most potent influences on instruction in mathematics and writing, respectively. There were greater differences in their assessment practices, due in part to the fact that the mathematics portfolios were on hiatus when the survey was conducted.

Curriculum and Instruction

Writing, reading and mathematics receive the most coverage from teachers in fourth and fifth grades who were responsible for all subjects. In addition, teachers were integrating writing and mathematics more with other subjects. They appeared to be shifting their content emphasis to reflect the subjects that are tested at their grade level. For example, two-thirds of the fifth-grade teachers who taught for the past three years, increased the time they spend on mathematics, and many fifth-grade teachers also increased the time they spend on arts and humanities and practical living/vocational studies, subjects which are tested at the fifth-grade level. Most of the fourth-grade teachers increased the time they devote to writing during the past three years, and many increased their coverage of science and reading. Increased coverage was accompanied by regular integration of lessons across subjects, e.g., writing with science and social studies, mathematics with writing and science.

Greater integration occurred at middle school, as well. Although we did not obtain strictly comparable information on this question from middle schools teachers, we do know that one-quarter of the seventh-grade writing teachers regularly worked with teachers in other subjects on student writing, and one-half increased the amount they work with teachers in other subject areas during the past three years. Similarly, one-quarter of the eighth-grade mathematics teachers regularly worked with teachers in other subjects on students' mathematics, and, during the past three years, 37 percent of eighth grade mathematics teacher increased the amount the work with teachers in other subjects.

In both subjects, teachers continued to emphasize many of the traditional topics even while they were increasing coverage of reform topics. Within the field of mathematics, the traditional topics of numbers and computation received at least weekly coverage from almost all teachers in fifth and eighth grade. Far fewer teachers in either grade level covered less-traditional topics of geometry and measurement or statistics and probability on a weekly basis. However, most teachers in both grade levels increased their coverage of the non-traditional mathematics topics during the past three years. In writing, about three-quarters of the teachers at both grade levels addressed most aspects of writing on a regular basis. This included (in order of prevalence) mechanics, use of effective language, idea development, sentence structure, logical organization, focus purpose and awareness of audience. Tone/voice and writing in a variety of genres were addressed weekly by more than one-half of seventh-grade writing teachers. The topics for which the greatest number of teachers increased coverage were focused purpose and awareness of audience, both aspects of writing that are strongly associated with the writing reform.

Teachers in both subjects aligned themselves philosophically with standards-based approaches to teaching more than traditional approaches. Moreover, teachers used both standards-based and traditional instructional strategies in their teaching, with increases occurring in the use of strategies consistent with reform. In mathematics, traditional instructional strategies were somewhat more common than standards-based strategies in the examples we posed (graphing, correcting student errors, and beginning and ending a new unit). However, most teachers endorsed student-centered responses over teacher-centered responses when dealing with individual student errors. In addition, a majority of teachers increased their use of standards-based instructional strategies during the past three years. Similarly, students were asked to engage in traditional learning activities more frequently than standards-based activities, but the frequency of the latter was increasing.

In writing, teachers' instructional philosophies were more aligned with standards-based approaches to teaching writing than with traditional approaches, and writing instruction had changed in the direction of the reform during the past three years. For example, almost all teachers used the writing process approach, but most used other approaches, as well. Teachers asked students to write for many different purposes, and often let the students choose the purpose for the piece. Pieces most often began with an idea or experience chosen by the student, and this practices increased during the past three years. Students devoted considerable time to producing written work, and their most common activities were practicing the mechanics of written English and having individual conferences about their writing.

Teachers in both subjects endorsed higher expectations for students—a prime tenant of the KERA reform—but have doubts about achieving it in practice. Although most mathematics teachers believed that all students can achieve more in mathematics than they have in the past, far fewer believed that all students can achieve at grade level.[33] Similarly, in writing, a majority of teachers believed all students can become successful writers, but only about half as many believed all students can achieve existing grade level expectations in writing.

Support for Changing Practices

In mathematics and writing most teachers were influenced greatly by the state curriculum materials and the KIRIS assessments. Of lesser importance were professional development, textbooks, and peers at the school level. Teachers in both subjects said they had the materials they needed to support instruction, and felt they received support and encouragement from the school principal and other teachers. However, few teachers in either subject thought they had adequate time to meet with their peers to plan new lessons.

Specifically, most mathematics teachers indicated that curriculum documents and materials developed by KDE and the National Council of Teachers of Mathematics had a great deal of influence on the content of their mathematics lessons. The KIRIS assessments themselves were also deemed quite influential by large numbers of teachers, particularly the mathematics portfolios and the open-response items. Only about one-third of the teachers regarded district curriculum guides, supplemental materials, and professional development as greatly influential. Many mathematics teachers drew substantial portions of their lessons from textbooks, and they reported that their texts supported traditional content better than other areas of mathematics, particularly connections between mathematics and other subjects. They also received support from their school administrators for their efforts to improve mathematics instruction.

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[33] Teachers would have responded in this way if they thought even a single student would not meet grade level expectations.

In writing, the KIRIS writing portfolios were the most potent factor in changing writing instruction. Almost all teachers indicated that the portfolios greatly influenced their teaching. Teachers also credited the portfolios with causing students to write more and better and for causing teachers to be more innovative in planning lessons. Furthermore, four of the six other factors that were perceived as influential by the majority of teachers were directly related to the portfolios: Kentucky Writing Portfolio Teacher Handbook, *Core Content for Writing Assessment*, portfolio scoring training and portfolio development training. *Transformations* and personal experience also influenced the content of most teachers' writing instruction. In contrast, textbooks were not very influential in terms of writing. Although the majority of teachers used a language arts or writing textbook they did not rely on it for writing assignments. Supplemental materials were used far more regularly in writing than textbooks.

Teachers were less encouraging about the factors that affected students' scores on KIRIS. In mathematics, although many teachers thought that the KIRIS assessments influenced classroom practices, they did not think that school effects were primarily responsible for KIRIS gains. The vast majority of teachers in schools whose mathematics scores improved during the second biennium attributed those improvements to factors outside their influence. In particular, gains were attributed to difference between cohorts of students far more often than to improvements in specific KIRIS-related skills or improvement in general mathematical knowledge and skill.

Similar responses were obtained in writing. The factor that largest percentage of teachers thought contributed greatly to KIRIS score gains was differences between cohorts of students. This was true despite the impact that KIRIS had on teaching practices and the positive-support teachers received for improving writing instruction. However, most teachers also thought improvements in students' writing skills made a moderate contribution to score gains.

Assessment Practices

Classroom assessment occurred frequently in both subjects, and the assessments were becoming more like KIRIS in format. Teachers continued to have mixed feeling about the KIRIS portfolios, which were seen to have a positive influence on instruction but to be overly burdensome. Specifically, in mathematics, teachers increased the amount of time they spent assessing students' mathematical skills, and they used problems that resembled KIRIS—short-answer open-response tasks and long-answer open-response tasks. Rarely did they use multiple-choice tests. When it came to problem solving, teachers used traditional types of problems more often than non-routine problems. However, during the past three years, most teachers increased their use of novel, non-routine problems and extended investigations that were consistent with Kentucky's standards-based approach. Although most teachers included many factors when assigning mathematics grades to students, during the past three years, most teachers have increased the weight that they give in student grades to open-response exercises and portfolio entries.

In writing, the four factors that were very important to most teachers when grading individual written work were idea development, accomplishing the focused purpose of the task, logical organization, and the quality and creativity of the ideas. Fewer teachers said that length, mechanics, or sentence structure were very important in reviewing work. This is consistent with the standards for written communications.

Teachers recognized strengths and weaknesses in the portfolio assessments, with writing teachers expressing more positive reactions than mathematics teachers.[34] Concerning the mathematics portfolios, teachers gave negative comments about the heavy emphasis on writing and the demands the portfolios placed on classroom time that made it difficult to cover the curriculum. Teachers agreed that portfolios had a positive effect on innovation, but they remained a burden on teacher and student time. Despite the burden, most teachers asked students to compile mathematics portfolios during 1996-97 even though the portfolios were not required by KDE. In writing, teachers were more enthusiastic. They agreed that the portfolios had many positive effects on teaching practices and student writing. However, they also found the writing portfolios to be burdensome and said the portfolios made it difficult to cover the regular curriculum.

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[34] The mathematics portfolios were being revised by the state at the time of this study, and that may have signaled to teachers that there were problems with the system.

Classroom Practices: Grade Level Differences

There were a few interesting differences between classroom practices in mathematics and writing in elementary schools and middle schools. Most differences were related to the content of elementary and middle school courses and the organization of elementary and middle schools.

In mathematics, the responses from fifth-grade teachers and eighth-grade mathematics teachers were quite similar with respect to their philosophies about teaching mathematics, expectations for students, curriculum emphases, instructional practices, assessment practices, and views about support for mathematics reform. There were noteworthy differences in background. Fifth-grade teachers had more teaching experience than eighth-grade mathematics teachers, and a higher percentage had master's degrees. However, eighth-grade mathematics teachers had more specialized training in mathematics, and, possibly as a result, a greater percentage felt adequately prepared to teach statistics and probability and algebraic ideas.

In addition, there a number of differences in how the two groups of teachers taught mathematics, some of which appear to be consistent with differences in the way elementary and middle schools are organized. Fifth-grade teachers were more likely than eighth-grade teachers to do the following: ask open-ended questions and show connections between mathematics and other subjects; have students regularly write about mathematics and work on extended mathematics activities; begin a mathematics unit in non-traditional ways, such as drawing on examples from other domains. In contrast, eighth-grade mathematics teachers are more likely than fifth-grade teachers to have students use calculators regularly to solve exercises and to cover the topic of algebraic ideas on a regular basis.

There were some differences in terms of classroom assessments, as well. A greater number of fifth-grade teachers than eighth-grade mathematics teachers had increased their use of novel, non-routing problems for assessing students in mathematics, and a greater number give substantial weight to participation in discussion and to interest and attitude toward mathematics when assigning grade.

In writing, similarities outweigh differences when comparing teaching in fourth and seventh grade, and many of the differences that do exist are related to the way instruction is organized at the two grade levels. For example, ability grouping is more common in assigning students to classroom in seventh grade than in fourth grade. Similarly, although the education level and teaching experience of fourth-grade teachers and seventh-grade writing teachers were similar, a higher percentage of seventh-grade writing teachers than fourth-grade teachers specialized in writing, English or language arts in the professional training program.

There were some differences in emphasis in the way writing was taught in fourth and seventh grades, but most are related to the age of students and their stage of writing development. For example, more fourth-grade teachers had their students write short pieces (one to two paragraphs in length) on a daily basis, and middle middle-length pieces (one to two pages) on a weekly basis. More fourth-grade teachers than seventh-grade writing teachers frequently used writing to learn and skills-based approaches to teaching writing. Fourth-grade teachers asked students to write for a greater number of purposes on a regular basis than seventh-grade writing teachers. In addition, a higher percentage of fourth-grade teachers regularly drew upon work from other subjects as a basis for writing, although a higher percentage of seventh-grade writing teachers had increased the frequency of this practice during the past three years. A greater percentage of fourth-grade teachers than seventh-grade teachers reported weekly practice on mechanics, weekly conferences with individual students, and weekly critiques of writing with the whole class. Feedback from adults at school was more common in fourth grade than in seventh grade, while peer conferences were more prevalent in seventh grade.

Classroom Practices: Relationship to KIRIS Gains

We found no consistent differences between teaching practices in high-gain and low-gain schools based on second biennium KIRIS gains. There were many cases in which standards-based practices were associated with high gains in one subject or one grade level, but not in all cases. There were also some instances in which traditional practices were associated with high gains. Overall, the results are provocative, but not conclusive.

In mathematics, with a few notable exceptions, teachers in high-gain schools and low-gain schools have similar backgrounds and report similar beliefs and practices. The exceptions include some practices that would be characterized as standards-based and others that would be identified as traditional. Some of the factors distinguish high-gain schools from low-gain schools at both grade levels and others apply only to fifth grade or only to eighth grade. In terms of background, the only difference associated with KIRIS gains is self-reported preparation; a greater percentage of teachers in high-gain than low-gain schools feel well-prepared to teach the more advanced mathematics topics, including algebraic ideas and statistics and probability.

Some curriculum and instructional differences are also associated with KIRIS gains, although most were detected only in eighth grade. More eighth-grade mathematics teachers in high-gain schools than low-gain schools did each of the following: increased their coverage of all mathematics topics during the past three years (with the greatest difference occurring in the areas of statistics and probability); had students practice computation on a daily basis; had students use calculators on a daily basis; give tests as culminating activities for instructional units. There was one difference in fifth grade in the other direction; a higher percentage of teachers in low-gain schools than high-gain schools increased coverage of statistics and probability during the past three years. In both grades, a greater percentage of teachers in high-gain schools than low-gain schools covered algebraic ideas on a regular basis.

There were a few strong associations between assessment practices and KIRIS gains. Multiple-choice tests were used infrequently in both grade levels, but more teachers in high-gain schools than low-gain schools eschewed their use entirely. Instead, more teachers in high-gain schools increased their use of extended investigations to assess student performance, and also increased the amount they counted performance tasks in grading. In eighth grade, a greater percentage of mathematics teachers in high-gain schools than low-gain schools gave weekly tests or quizzes, and a greater percentage assessed students frequently using problems that were more difficult than those learned in class. In fifth grade, there were some opposite results. More teachers in low-gain schools than high-gain schools increased the amount of time they spend on mathematics assessment.

Among eighth-grade mathematics teachers there were also some associations between KIRIS gains and school support for mathematics reform. A greater percentage of eighth-grade mathematics teachers in high-gain schools than low-gain schools said the content of their mathematics lessons was strongly influenced by other school staff, including the principal, resource teachers and other teachers. District curriculum specialists also had a strong influence on content among eighth-grade mathematics teachers in high-gain schools. Similarly, more eighth-grade teachers in high-gain schools said the NCTM standards had strong influence over mathematics content and practices, and that supplementary materials had a strong influence on teaching practices. Not surprisingly, more eighth-grade mathematics teachers in high-gain schools than low-gain schools thought KIRIS had a positive impact on their schools' mathematics program. In fifth grade, more teachers in high-gain schools than in low-gain schools have textbooks that support the curriculum well. In both grades, twice as many teachers in high-gain schools than low-gain schools reported increases in the availability of remedial and enrichment support for students in mathematics.

Similarly, in writing, there was little difference in background, teaching experience, or writing training between teachers in high-gain and low-gain schools, but there were of differences in other areas. On balance, the practices associated with KIRIS gains were consistent with the Kentucky writing reform, including integration of writing with other subjects, greater attention to certain aspects of writing such as writing in a number of genres/forms, student-centered instruction, regular writing of longer pieces, and using more elements of the writing process, including drafting, conferencing and revising. For example, in both grades more teachers in high-gain schools than in low-gain schools integrated writing with other disciplines, particularly social studies. In addition, more seventh-grade writing teachers from high-gain schools than low-gain schools increased the frequency with which they work with teachers from other subjects.

There were differences between high-gain and low-gain schools in the emphasis teachers placed on various aspects of writing. More teachers in high-gain schools increased their emphasis on writing in a variety of genres/forms during the past three years. In seventh grade, teachers in high-gain schools also increased their coverage of use of effective language, sentence structure, logical organization, tone/voice, mechanics, and idea development. At the same time, a greater percentage of seventh-grade writing teachers in high-gain schools than low-gain schools used skill-based instruction regularly and had students regularly practice the mechanics of written English.

There were some differences in the process of writing between high-gain and low-gain schools. In both grades, greater percentages of teachers in high-gain schools increased the frequency of individual student conferences about writing, and learning about genres/forms. In seventh grade, a greater number of teachers from high-gain schools had students regularly write for a purpose of their own choosing, and greater numbers of teachers also have students regularly engage in making notes or an outline and in revising written pieces at least once. In addition, more seventh-grade writing teachers in high-gain school increased the frequency of critiquing writing with the whole class and of reading and discussing a professional author's work.

In addition, there were some differences in length of written work and in use of time. In both grades, a greater number of teachers in high-gain schools than low-gain schools reported at least monthly production of written pieces three pages in length or longer. In seventh grade, teachers in high-gain schools reported that their students spent more time completing assessment portfolio entries than teachers in low-gain schools.

There were also some associations that were harder to explain. Teachers in low-gain schools were more positive about the impact of writing portfolios than teachers in high-gain schools. Similarly, teachers in low-gain were more likely to say that the writing portfolios had a positive effect on student writing, that portfolio scores were a good measure of writing achievement, that students could achieve grade level expectations in writing. Teachers in low-gain schools were more likely than teachers in high-gain schools to report that the Kentucky Writing Program had a great deal of influence on what they taught in writing.

Conclusions

There is ample evidence that teachers have changed classroom practices in response to KERA and KIRIS, and that KIRIS, in particular, has had a major influence on instructional behaviors. In general, this was true in mathematics and writing and in both the elementary and the middle school grades. Notably,

- Although teachers continued to cover traditional content and use traditional methods, they increased the frequency of standards-based approaches.
- The majority of teachers' beliefs about teaching were closer to the standards-based approach than the traditional one.
- Elementary teachers increased their coverage the subjects tested by KIRIS at their grade level.
- Writing teachers perceived the portfolios to be a strong positive influence on students' writing ability.

However, there were no consistent associations between specific teaching practices and biennial KIRIS gains. Some standards-based practices were more prevalent in high-gain schools, e.g., extended investigations in mathematics, longer-pieces and more frequent student conferences in writing. However, gains were also associated with some traditional practices, such as regular mathematics tests and regular practice on the mechanics of written English. In some cases, gains were associated with particular types of support, e.g., the influence of local school staff on mathematics curriculum. Overall, we did not find convincing evidence that a particular set of actions or policies would produce higher scores. If there is such a pattern it would appear to include both standards-based and traditional approaches.

It is possible to draw both optimistic and pessimistic interpretations of these findings. On the one hand, standards-based reform is a relatively recent event in Kentucky. The first KIRIS examinations were just administered in 1991. The bulk of the literature on school reform indicates that it is difficult and time-consuming to change teaching practice. The surveys reveal widespread changes in the direction encouraged by KERA, which should be applauded. On the other hand, it is disappointing not to have found stronger links between practices and student performance. There are a number of reasons we may have failed to detect relationships that are really there, including the volatility of gain scores, the sensitivity of our instruments, and the timing of our survey.[35] However, it may also be the case that Kentucky educators have not found a practice or constellation of practices that consistently promotes higher achievement across groups of students.

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[35] We compared practices that occurred in 1996-97 and changes in practice during the preceding three-year period with school-level gain scores representing growth from 1992-94 to 1994-96.

It is important to remember that this is only the first year of our study. A new survey was administered in the spring of 1998. This survey will provide information about practices in mathematics and writing in adjacent grade levels (e.g., fourth- and fifth-grade mathematics) so it should reveal more about the effects of standards-based assessment on classroom practices in grades that are not subject to accountability testing. Using subsequent years' KIRIS scores, we will also be able to look at associations between teachers' behaviors and student outcomes that are closer in time. In addition, our case studies of exemplary teaching will illuminate more about a highly selected set of teachers and the way the elements of their school context interact to promote the desired teacher and student behaviors.

REFERENCES

Bond, L. (1994). *Surveying the landscape of state educational assessment reforms*. Washington, DC: Council for Educational Development and Research.

Center on Organization and Restructuring of Schools (1994, Spring). *Teacher Questionnaire*. Madison: University of Wisconsin, Center for Education Research.

Hoffman, R. G., Koger, L., & Awbrey, A. (1997, April). *Punctuation and subject/verb agreement skills under the Kentucky Education Reform Act*. LRS97-1. Frankfort: Kentucky Department of Education, Bureau of Learning Results Services.

Kentucky Department of Education (1994, July). *Kentucky's learning goals and academic expectations*. Frankfort: Author.

Kentucky Department of Education (1995a, September). *Transformations: Kentucky's Curriculum Framework, Volume I*. Frankfort: Author.

Kentucky Department of Education (1995b, September). *Transformations: Kentucky's Curriculum Framework, Volume II*. Frankfort: Author.

Kentucky Department of Education (undated). *Core content for mathematics assessment*. Frankfort: Author.

Koretz, D., Barron, S., Mitchell, K., & Stecher, B. (1996). *Perceived effects of the Kentucky Instructional Results Information System (KIRIS)*. MR-792-PCT/FF. Santa Monica: RAND.

Koretz, D., Stecher, B. M., Klein, S., & McCaffrey, D. (1994, Fall). The Vermont portfolio assessment program: Findings and implications. *Educational Measurement: Issues and Practices, 13(3)*, 5–16. (Reprinted as RAND, RP-366, 1995.)

National Council of Teachers of Mathematics (1989). *Curriculum and evaluation standards for school mathematics*. Reston, VA: The Council.

Porter, A. C., & Smithson, J. L. (1995). *Enacted curriculum survey items catalogue: Middle school and high school mathematics and science)*. Madison: University of Wisconsin, Center for Education Research.

Resnick, L. B., & Resnick, D. P. (1992). Assessing the thinking curriculum: New tools for educational reform. In B. R. Gifford & M. C. O'Connor (Eds.), *Changing assessments: Alternative views of aptitude, achievement, and instruction*. Boston: Kluwer Academic Publishers.

Stecher, B. M., & Mitchell, K. J. (1995). *Portfolio driven reform: Vermont teachers' understanding of mathematical problem solving* (CSE Tech. Rep. No. 400). Los Angeles: University of California, National Center for Research on Evaluation, Standards, and Student Testing (CRESST).

Stiggins, R. (1991). Assessment literacy. *Phi Delta Kappan, 72*, 534-539.

Wiggens, G. (1989). A true test: Toward more authentic and equitable assessment. *Phi Delta Kappan, 70*, 703-713.

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